Final – Revision 1

Addendum No. 2— Underwater Intrusive Investigation Work Plan to Conduct Phase I RCRA Facility Investigation

Piñeros and Cabeza de Perro Islands Naval Activity Puerto Rico

Contract Task Order JM03

October 2011

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic

Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

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Atlanta, Georgia

Contents

Appendixes

Tables

Figures

Acronyms and Abbreviations

ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BRAC	Base Realignment and Closure
CAP	Corrective Action Plan
CAR	Corrective Action Request
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action—Navy
DDESB	Department of Defense Explosives Safety Board
DFOW	definable feature of work
DGM	digital geophysical mapping
DGPS	differential global positioning system
DoD	Department of Defense
DoDI	Department of Defense Instruction
DQO	data quality objective
EIS	Environmental Information Specialist
EOD	explosive ordnance disposal
EQB	Environmental Quality Board
ESQD	explosives safety quantity distance
ESS	Explosives Safety Submission
EZ	exclusion zone
GPS	global positioning system
HFD	hazardous fragment distance
HSM	Health and Safety Manager
HSP	Health and Safety Plan
ISO	industry standard object
LAW	light anti-tank weapon
MC	munitions constituents
MD	munitions debris
MDAS	material documented as safe
MEC	munitions and explosives of concern
MFD	maximum fragment distance
MGFD	munition with the greatest fragmentation distance
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MRS	munitions response site
MRSIMS	munitions response site information management system

NAPR	Naval Activity Puerto Rico
NAVFAC	Naval Facilities Engineering Command
NAVSCOLEOD	Naval School Explosive Ordnance Disposal
NEW	net explosive weight
NFESC	Naval Facilities Engineering Service Center
OTS	Ocean Technologies Systems
PM	Project Manager
PMO SE	Project Management Office Southeast
QA/QC	quality assurance/quality control
QC	quality control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SM	Site Manager
SOP	standard operating procedure
SSC	Site Safety Coordinator
SUXOS	Senior Unexploded Ordnance Supervisor
TBD	to be determined
TSD	team separation distance
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
UXOSO	Unexploded Ordnance Safety Officer
UXOQCS	Unexploded Ordnance Quality Control Specialist

SECTION 1
Introduction

CH2M HILL is conducting a Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico (NAPR) for the Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC), and Base Realignment and Closure (BRAC) Program Management Office Southeast (PMO SE). The current phase of work is being performed under the Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000 Program, Contract No. N62470-08-D-1000, Contract Task Order JM03.

1.1 Background and Project Objective

This document is an addendum to the *Work Plan to Conduct Phase I RFI, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* (CH2M HILL, 2006). Field investigations conducted in 2006 under that Work Plan resulted in the identification of geophysical anomalies representing potential munitions and explosives of concern (MEC) at terrestrial and underwater locations.

The first addendum to the *Work Plan, Addendum No.1- Terrestrial Intrusive Investigation Work Plan to Conduct Phase I RFI, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* (CH2M HILL, 2010a), addressed the investigation of selected terrestrial anomalies on Piñeros Island. This addendum addresses the investigation of three suspected former underwater demolition areas, UW-1, UW-2, and UW-3, adjacent to Piñeros and Cabeza de Perro Islands, as shown in **Figure 1-1**. Data gathered during this investigation will support the RFI project objective: to evaluate the potential for MEC to be present at three suspected underwater demolition areas surrounding Piñeros and Cabeza de Perro Islands.

Underwater investigation of a fourth suspected former underwater demolition area, UW-4, is not expected to be feasible due to the technical difficulties associated with diving in the rough seas and strong currents that are reported at this location. Furthermore, the conditions in this area, including deep water, lack of adjacent beaches, and the inaccessibility to Cabeza de Perro Island, make it unlikely that unauthorized recreational uses will be made of this area.

1.2 Work Plan Addendum Scope and Organization

As stated in the previous section, this document is an addendum to the existing Phase I RFI Work Plan (CH2M HILL, 2006). Sections of the existing Work Plan that apply to this phase of work will be referenced where applicable rather than incorporating them into this addendum. This Work Plan Addendum presents the detailed approach specifically to be used for implementing MEC investigation activities in the suspected underwater demolition areas. The project objectives will be accomplished through the performance of the following activities:

- Visual survey and intrusive investigation of 10 percent of each underwater investigation area, shown on **Figure 1-2**.
- Removal of MEC and material potentially presenting an explosive hazard (MPPEH) that is safe to move and land-based demolition and disposal, if necessary. (MEC/MPPEH that is not safe to move will be left in place and a determination on the final disposition will be made in conjunction with the Navy.)

This Work Plan Addendum is divided into sections providing information on the detailed approach, including procedures to be employed during the execution of the specific field tasks necessary to complete the MEC investigation within the underwater investigation areas. Appendixes to the Phase I RFI Work Plan (CH2M HILL, 2006) and this Addendum provide supporting documentation that details specific procedures for the execution of the project.

This Work Plan Addendum is consistent with the Explosives Safety Submission (ESS) (CH2M HILL, 2010d) that will be submitted to the Naval Ordnance Safety and Security Activity.

This Work Plan Addendum is organized as follows:

- **Section 1, Introduction,** provides general information about this Work Plan Addendum and presents the project scope and objectives.
- **Section 2, Technical Management Plan,** identifies the overall technical approach, methods, and operational procedures that will be used to execute underwater MEC investigation activities.
- **Section 3, Field Investigation Plan,** identifies the specific methods and operational procedures that will be used to execute underwater field investigation activities, to include mobilization/demobilization; MEC avoidance, anomaly detection, excavation, identification, and removal; documentation of coral and sea grass; proper demilitarization and disposal of MEC and MPPEH; and post-detonation soil sampling.
- **Section 4, Quality Control Plan** (QCP), provides details of the approach, methods, and operational procedures to be employed for quality control (QC) of the field investigation activities. Parts of this section will refer to the original approved Phase I RFI Work Plan (CH2M HILL, 2006).
- **Section 5, Explosives Management Plan,** addresses the management of explosives in accordance with applicable regulations.
- **Section 6, Explosives Siting Plan**, provides explosives safety criteria for planning and siting explosives operations.
- **Section 7, References,** lists the references cited or used in the preceding sections.

The underwater field investigation will be also be conducted in accordance with *Biological Assessment for Removal of Munitions and Explosives of Concern, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* (CH2M HILL, 2009), *Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern, Piñeros and Cabeza de Perro Islands, Naval*

*Activity Puerto Rico (*CH2M HILL, 2010b), and *Supplemental Biological Assessment: Destruction of Underwater Munitions and Explosives of Concern on Isla Piñeros, Naval Activity Puerto Rico* (CH2M HILL, 2011) (Appendix E).

1.3 Site Location and Description

Section 1.3 of the Phase I RFI Work Plan (CH2M HILL, 2006) provides detailed information on the site location and description. This Work Plan Amendment addresses three underwater investigation areas, each of which is composed of a suspected underwater demolition area and the seafloor between this area and the nearest beach, as shown on **Figure 1-2**. These areas were selected for investigation based on the potential hazards posed by the suspected historical use of the areas, and because unauthorized recreational activities, such as boat anchoring, snorkeling, and scuba diving, have been observed in these areas.

A survey of the suspected underwater demolition areas was conducted in 2006 to evaluate the presence of coral species in these areas. This survey provided the following descriptions:

- Area UW-1 is in approximately 20 to 25 feet of water. In 2006, the seafloor consisted mainly of sand with little to no coral.
- Area UW-2 is in approximately 15 feet of water. In 2006, the seafloor consisted mainly of sand and turtle grass (*Thalassia testudinum*) interspersed with occasional corals. A small 15-foot-wide by 15-foot-long by 5-foot-high mounded section of hard coral (likely lettuce coral [*Agaricia agaricites*]) was situated along the southern border of the UW-2. Outside the northwestern corner of UW-2, a large piece of dead elkhorn coral (40 feet wide by 40 feet long by 10 feet high) was found that fire coral (*Millepora sp.*), sea fans (*Gorgonia sp.*), and sea whips (*Leptogorgonia sp.*) had colonized. The dead elkhorn coral reef had heights that were within 5 feet of the water surface and required avoidance by boats.
- Area UW-3 is in less than 8 feet of water. In 2006, the seafloor was covered by sand and turtle grass. No coral formations were observed in this area. The southwestern portion of UW-3 had apparent debris representing potential MEC/MPPEH items on the seafloor that was not investigated further.

In addition to the three areas addressed by this Work Plan Addendum, a fourth suspected underwater demolition area, Area UW-4, is off the northern point of Cabeza de Perro in water 25 feet deep along the southern edge near the island to greater than 35 feet deep along the northern edge. No snorkeling was conducted in this area in 2006, but observations taken from the boat included only smooth bottom contours, indicative of the absence of coral reefs. This area is not addressed in this investigation because underwater investigation of UW-4 is not expected to be feasible due to the technical difficulties associated with diving in the rough seas and strong currents that are reported at this location. Furthermore, the conditions in this area, including deep water, lack of adjacent beaches, and the inaccessibility to Cabeza de Perro Island, make it unlikely that unauthorized recreational uses will be made of this area.

1.4 Site History

Section 1.4 of the Phase I RFI Work Plan (CH2M HILL, 2006) provides a detailed history of Piñeros and Cabeza de Perro Islands.

Beginning in the late 1950s, Piñeros and Cabeza de Perro Islands were utilized by U.S. Special Warfare Group Two, Unit Four (SPECWAR) personnel for various training activities. Piñeros exercises included beach landings combined with sea-to-land firing and underwater demolition on offshore coral reefs; no specific information was related to Cabeza de Perro.

Before 1987, training activities took place on all parts of Piñeros Island and in near offshore shallow waters around Piñeros and Cabeza de Perro Islands. Approximately 300 men, in groups of 50, were trained each year in underwater diving and demolition techniques. Underwater demolitions teams used two beaches on the northern coast of Piñeros to practice detonating up to 500 pounds of underwater demolition charges. Training on the south shore included setting up explosive charges for detonation, which had an emplacement of 12 to 15 obstacles in the surf zone and shoal waters just off the beach.

History of MEC use within the near shore waters Cabeza de Perro Islands remains unknown; there are no reports to confirm MEC use. However, underwater areas UW-1 through UW-4, shown on **Figure 1-1,** were defined as sites of suspected former underwater demolition training based on historical charts.

1.5 Previous Investigations

Previous terrestrial investigations of Piñeros Island are detailed in the *Draft Phase I RFI Report - Terrestrial Investigation, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* (CH2M HILL, 2010c). These investigations resulted in the following list of munitions and demolition materials used on the island or in the surrounding waters that could potentially be encountered:

- Projectiles
- Rockets
  - 66mm M72A2 light anti-tank weapon (LAW) rocket (remnants confirmed)
- Grenades
  - 40mm, practice, including M382, M385, M407, M781
  - Hand, Fragmentation, including MK II, M33, and M67
  - Hand, Offensive, MK3
  - Hand, Incendiary, TH3, AN-M14
  - Hand, Illuminating, MK1
  - Hand, Smoke, including AN-M8 Series and M18 series
  - 40mm, Smoke, including M676, M680, M682
  - 40mm, Parachute, M583, M661, and M662
  - WP, Grenades including M15, M34

- Explosives
  - C-3
  - C-4
  - TNT
  - 20-lb. crater charges
  - 40-lb. crater charges
  - Military Dynamite (M-1)
  - Claymore mines (training)
  - Detonation cord
  - Electric and non-electric blasting caps
  - Chemical delay blasting caps
  - Limpet mines with Mk48 timers
  - Explosive fasteners

- Pyrotechnics
  - M583A1 star shells
  - 37mm star flares
  - Signal, Illumination, Ground, M187, M188, M189
  - Signal, Illumination, Ground, White Star, M127
  - Signal, Illumination, Ground, Red Star, M126
  - Signal, Illumination, Ground, Green Star, M195

Recovered MEC and MPPEH items documented to date are limited to terrestrial locations. No records exist of MEC/MPPEH having been recovered in the waters off Piñeros and Cabeza de Perro islands. Undocumented reports of munitions-related items being found in the waters surrounding Piñeros and Cabeza de Perro islands include empty missile cases, empty shoulder-launched multipurpose assault weapon tubes, small arms ammunition, and the remains of a 66mm M72A2 (LAW) Rocket.

No previous underwater intrusive investigations have been completed for the suspected demolition areas, UW-1, UW-2, UW-3 and UW-4; however, digital geophysical mapping (DGM) of the four areas was conducted in 2006 as part of the Phase I RFI. The DGM was performed by Sonographics, Inc. between October 18 and October 22, 2006. During this DGM effort, a bathymetric survey of each investigation area was completed first using a side-scan sonar towfish and a differential geographical positioning system (DGPS) navigation system. Then a Geometrics model G882 cesium vapor magnetometer towfish, coupled with a DGPS navigation system, was used to survey the suspected underwater demolition areas. Within these areas no significant targets were identified, although a total of 217 anomalies were detected. Coral heads, coral reefs, turtle grass, sand waves, and ripples were observed. Potential shipwrecks were observed northwest of UW-1 and UW-4.

Figures 1-3 through **1-6** show the locations of anomalies detected in the underwater DGM surveys in UW-1 through UW-4. The number of anomalies found in each area is listed in **Table 1-1.** A summary report for the DGM is provided in **Appendix A.**

TABLE 1-1
*G*eophysical Anomalies, October 2006

Suspected Underwater Demolition Area	Total Number of Anomalies
UW-1	44
UW-2	53
UW-3	88
UW-4	32
TOTAL	217

Based on the results of the DGM survey, anomalies potentially representing MEC are present on the seafloor at UW-1, UW-2, UW-3, and UW-4. Because of the dynamic nature (tidal movement and wave action) of seafloor sediments, sources of the geophysical anomalies detected during the October 2006 DGM effort may have shifted or may no longer be present. In addition, the ability to accurately reacquire all previously identified anomalies within the underwater areas is uncertain as a result of tidal action and wave movement.

VICINITY MAP

LEGEND

Suspected Former Underwater Demolition Areas

N

0 450 900
Feet

FIGURE 1-1
Suspected Former Underwater Demolition Areas
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

VICINITY MAP

LEGEND

Planned Underwater Investigation Area

Suspected Former Underwater Demolition Area

N

0 300 600
Feet

FIGURE 1-2
Planned Underwater Investigation Areas
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

\\GALILEO\PROJ\PINEROSISLAND\MAPFILES\400714_RCRA_RFI\FIGURE 3-1 - PLANNED UW INVESTIGATION AREAS.MXD BHATHAWA 11/2/2010 17:05:04

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VICINITY MAP

LEGEND

- DGM Anomaly (2006 Survey)
- Suspected Former Underwater Demolition Area

N

0 60 120
Feet

FIGURE 1-3
DGM Survey Results: UW-1
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

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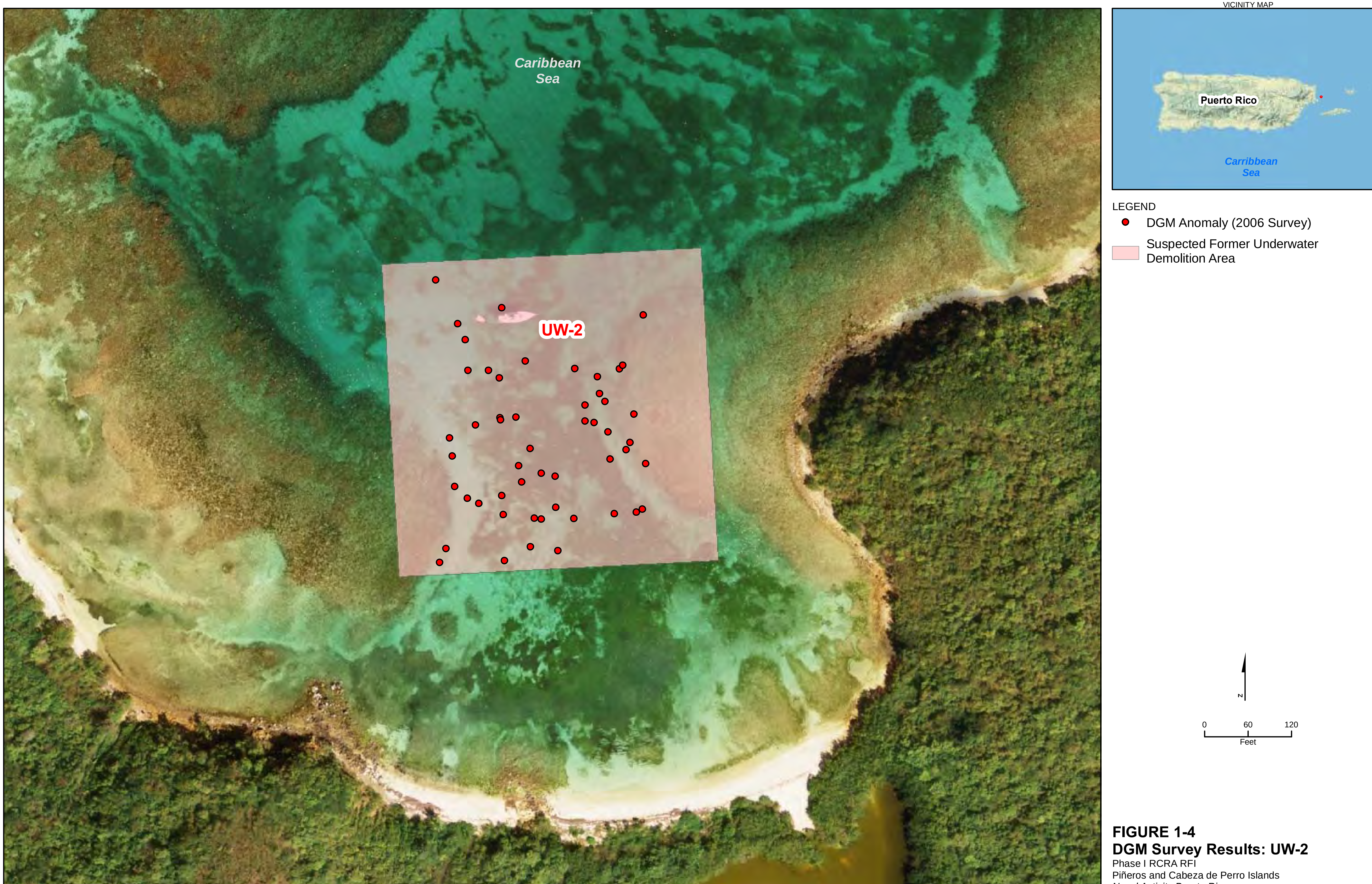
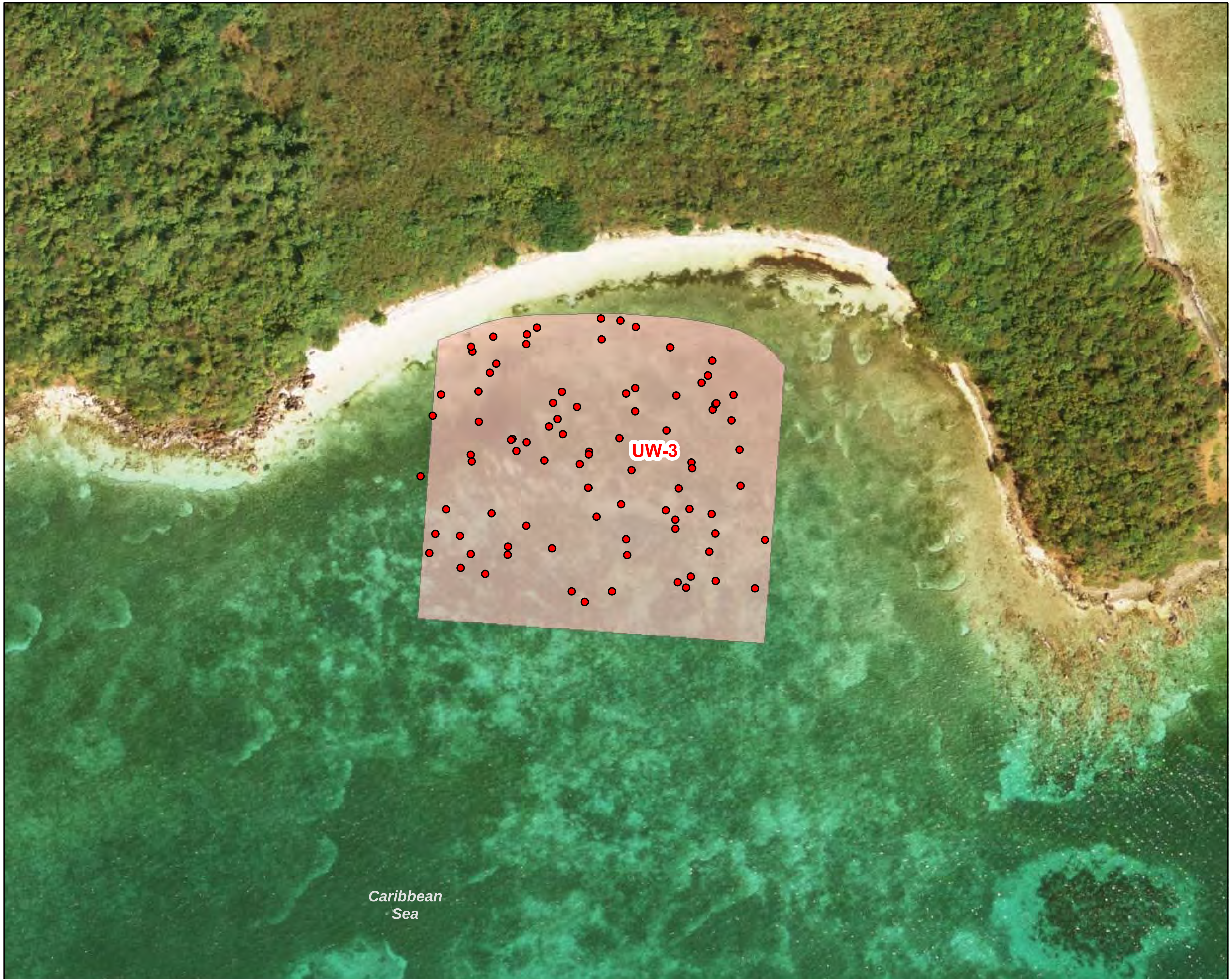


FIGURE 1-4
DGM Survey Results: UW-2
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico



LEGEND
DGM Anomaly (2006 Survey)
Suspected Former Underwater Demolition Area

0 60 120
Feet

FIGURE 1-5
DGM Survey Results: UW-3
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

CH2MHILL

\\GALILEO\PROJ\PINEROSISLAND\MAPFILES\400714_RCRA_RFI\FIGURE 1-4 - DGM RESULTS - UW3.MXD BHATHAWA 11/3/2010 09:59:32

VICINITY MAP

LEGEND

- DGM Anomaly (2006 Survey)
- Suspected Former Underwater Demolition Area

N

0 60 120
Feet

FIGURE 1-6
DGM Survey Results: UW-4
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

SECTION 2

Technical Management Plan

2.1 Project Organization, Personnel, and Schedule

2.1.1 Project Organization

No changes have been made to the project organization presented in the Phase I RFI Work Plan (CH2M HILL, 2006), to which this document is an addendum.

2.1.2 Project Personnel

The following project personnel have changed since the Phase I RFI Work Plan was issued (CH2M HILL, 2006). **Table 2-1** provides updated contact information for project team members.

TABLE 2-1
Updated Project Personnel Contact Information

Name/Title/Organization	Mailing Address	Telephone/Fax/E-mail
Stacin Martin Navy Technical Representative NAVFAC	NAVFAC Atlantic EV31 6506 Hampton Blvd, Bldg A Norfolk VA 23508	757-322-4780 (office) stacin.martin@navy.mil
Mark Davidson Navy Technical Representative NAVFAC BRAC PMO SE	BRAC PMO SE 4130 Faber Place Dr. Suite 202 N. Charleston, SC 29405	843-743-2124 (office) mark.e.davidson@navy.mil
Timothy Garretson Senior MR Technical Consultant CH2M HILL	9428 Baymeadows Road Suite 300 Jacksonville, FL 32256	904-374-5633 (office) 757-287-5222 (cell) timothy.garretson@ch2m.com

The roles and responsibilities of the key personnel are discussed below:

- Navy Technical Representative—Stacin Martin will represent the Navy's interests in all activities on this project. As a NAVFAC staff member, Mr. Martin will review all CH2M HILL submittals and track the project's financial and schedule performance.
- Navy BRAC PMO SE Project Manager – Mark Davidson.
- Senior Munitions Response (MR) Technical Consultant—Tim Garretson will serve as Senior MR Technical Consultant and will provide quality assurance (QA) reviews on all submittals.

- Site Manager (SM) -To be determined (TBD). The Senior Unexploded Ordnance Supervisor (SUXOS)-qualified SM will be CH2M HILL's onsite representative to coordinate and oversee the activities of field support personnel and subcontractor personnel. The SM is also responsible for implementation of and compliance with the Health and Safety Plan (HSP) (**Appendix B**) and QC requirements during the field effort.

2.1.3 Project Schedule

Mobilization and site work in the MR site (MRS) work areas is planned for March –April 2011. This schedule avoids fieldwork during the sea turtle nesting season of June 1 through December 31. The schedule for completing the Phase I RFI underwater investigation is provided as **Figure 2-1**. This schedule will be revised as the project progresses.

2.2 Technical Approach

The technical approach to field operations includes the primary tasks identified herein. The general steps relating to field operations that will be implemented during the intrusive investigation are described in this section. More-detailed procedures are provided elsewhere in this Addendum and in the Phase I RFI Work Plan (CH2M HILL, 2006).

2.2.1 Task 1—Project Planning

This task consists of project management, meetings, Addendum preparation, and subcontractor procurement.

Project management includes all work necessary for controlling the project budget and schedule. This includes monthly status reports and invoicing, as well as all other administrative tasks needed for project performance.

Telephone-based meetings are planned throughout the course of this project. The meetings will be held to discuss proposed work, present investigation findings, and discuss project status.

Three versions of this Addendum will be prepared under this task. This draft Addendum will be submitted electronically for Navy review. A revised Addendum that incorporates Navy comments will be submitted for regulatory review. A final Addendum will be prepared that will address all comments on the draft document.

Subcontractor procurement is also included under this task. Anticipated subcontractor services include MEC-related services, charter boat services, analytical laboratory services, and data validation services.

2.2.2 Task 2 – Underwater Biological Assessment

This task consists of ecological support in planning the underwater investigation. CH2M HILL personnel, including a qualified biologist, will consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to develop acceptable approaches for conducting the underwater investigation. CH2M HILL will develop a Biological Assessment that fulfills the requirements of Section 7 of the Endangered Species Act by addressing the potential impacts to protected species associated with the underwater investigation and subsequent removal of safe-to-move MEC/MPPEH from the investigation areas.

A *Biological Assessment (BA) for Investigation of Underwater Mentions and Explosives of Concern* (CH2M HILL, 2010b) was submitted to the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) and the NMFS Essential Fish Habitat Division in November 2010. These agencies subsequently concurred that the proposed activities are not expected to adversely impact any listed threatened or endangered species.

A *Supplemental Biological Assessment: Destruction of Underwater Munitions and Explosives of Concern on Isla Piñeros, Naval Activity Puerto Rico* (CH2M HILL, 2011) was submitted to USFWS on May 31, 2011, requesting modifications to allow inland demolition if activities are conducted during turtle nesting season. The USFWS subsequently concurred that the proposed activities are not expected to adversely impact any listed threatened or endangered species. NMFS concurred that NMFS review of the Supplemental BA was not needed.

The BA, Supplemental BA, and regulatory concurrence letters are provided in Appendix E.

2.2.3 Task 3—Site Work

All field activities will be performed under this task. The field investigation will be conducted in phases. The scope of the field investigation and the detailed technical procedures are presented in Section 3. The primary field investigation activities include:

- Site preparation consisting of mobilizing personnel and equipment
- Underwater MEC/MPPEH investigation, consisting of the following activities:
  - Layout of underwater transects using MEC avoidance procedures
  - "Detect-and-dig" underwater intrusive investigation of anomalies encountered along transects
  - Documentation of coral and sea grass locations within and adjacent to 100% of each underwater investigation area for use in biological assessments in the event that underwater demolitions are needed during a future phase of work.
  - MEC/MPPEH that is safe to move will be transported to Piñeros Island and demolished/demilitarized as necessary by controlled detonation. During sea turtle nesting season, June 1 through November 30, MPPEH storage and processing and MEC demolition will be conducted in an area along the South Bunker Trail. During other times of the year, these activities will be conducted on an adjacent beach. (MEC/MPPEH that is not safe to move will be left in place and a determination on the final disposition will be made in conjunction with the Navy.)

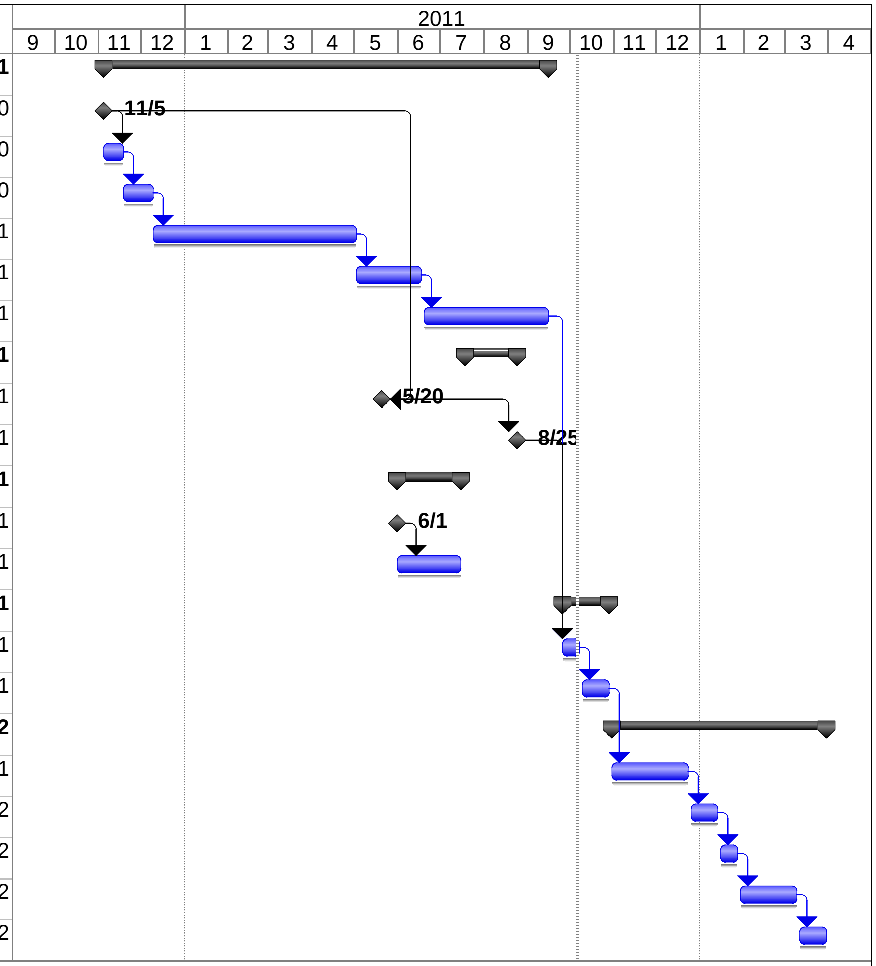
2.2.4 Task 4—Sample Management, Analysis, and Validation

This task consists of management of environmental sample data from the time the samples are collected until the validated data are received and incorporated into the project reports. This will be performed if surface soil samples for MC analysis are collected at locations where controlled detonations of MEC/MPPEH are performed. Details for this task are provided in the next section of this Addendum and in Section 3.5 of the Phase I RFI Work Plan (CH2M HILL, 2006).

2.2.5 Task 5—Reporting

A Phase I RFI Report will be prepared to document the findings of the underwater field investigation.

ID	Task Name	Duration	Start	Finish
1	**Phase I (Underwater) RFI Work Plan**	**225 days**	**Fri 11/5/10**	**Thu 9/15/11**
2	Submit Internal Draft WP for Client Review	0 days	Fri 11/5/10	Fri 11/5/10
3	Client Review of Internal Draft WP	2 wks	Fri 11/5/10	Thu 11/18/10
4	Prepare Draft WP for Regulatory Review	3 wks	Fri 11/19/10	Thu 12/9/10
5	Regulatory Review of Draft WP	20.4 wks	Fri 12/10/10	Mon 5/2/11
6	Prepare Final Work Plan	6.8 wks	Tue 5/3/11	Fri 6/17/11
7	Work Plan Approval and Notice to Proceed	12.8 wks	Mon 6/20/11	Thu 9/15/11
8	**Explosives Safety Submission**	**27 days**	**Tue 7/19/11**	**Thu 8/25/11**
9	Submit ESS to NOSSA	0 days	Fri 5/20/11	Fri 5/20/11
10	DDESB Approval of ESS	0 wks	Thu 8/25/11	Thu 8/25/11
11	**Biological Assessment**	**33 days**	**Wed 6/1/11**	**Fri 7/15/11**
12	Submit Supplemental BA for USFWS Review	0 days	Wed 6/1/11	Wed 6/1/11
13	USFWS Review of Supplemental BA	33 days	Wed 6/1/11	Fri 7/15/11
14	**Field Work**	**25 days**	**Mon 9/26/11**	**Fri 10/28/11**
15	Mobilization	2 wks	Mon 9/26/11	Fri 10/7/11
16	Field Investigation	3 wks	Mon 10/10/11	Fri 10/28/11
17	**Phase I (Underwater) RFI Report**	**110 days**	**Mon 10/31/11**	**Fri 3/30/12**
18	Prepare Internal Draft RFI Report	8 wks	Mon 10/31/11	Fri 12/23/11
19	Client Review of Internal Draft RFI Report	3 wks	Mon 12/26/11	Fri 1/13/12
20	Revise Draft RFI Report	2 wks	Mon 1/16/12	Fri 1/27/12
21	Regulatory Review of Draft RFI Report	6 wks	Mon 1/30/12	Fri 3/9/12
22	Prepare Final RFI Report	3 wks	Mon 3/12/12	Fri 3/30/12



Project: CTO-JM03, Underwater Investigation, Phase I RFI
Piñeros Island, Naval Activitiy Puerto Rico

Task		Project Summary
Split		External Tasks
Progress		External Milestone
Milestone		Deadline
Summary		

SECTION 3

Field Investigation Plan

The principal objectives of this field event are to:

- Perform an underwater investigation to characterize the potential presence of MEC and MPPEH in the underwater investigation areas
- Demilitarize and dispose of any safe-to-move MEC/MPPEH identified during the course of the underwater investigation

These objectives will be accomplished during the field investigation through the following activities, which will be conducted in accordance with CH2M HILL standard operating procedures (SOPs) provided in Appendix E of the Phase I RFI Work Plan (CH2M HILL, 2006):

- Visual observation by divers of the seafloor along transects within underwater investigation areas UW-1, UW-2, and UW-3
- Detection of anomalies by divers using Whites Dual Pro PI underwater all-metals detectors (or equivalent) along transects within underwater investigation areas UW-1, UW-2, and UW-3
- Investigation of detected anomalies using hand tools at depths of up to 1 foot beneath the surface of seafloor sediments
- Documentation of coral and sea grass locations within and adjacent to 100% of each underwater investigation area for use in biological assessments in the event that underwater demolitions are needed during a future phase of work. Removal of MEC/MPPEH that is safe to move and transfer to demolition/processing sites on Piñeros Island, with subsequent demolition/demilitarization using controlled detonation as necessary.
- Soil sampling for MC analysis at controlled detonation locations.
- Offsite disposal of material documented as safe (MDAS) and any other debris found or generated during field work.

3.1 Mobilization and Demobilization

Mobilization and demobilization will be conducted as described in Sections 3.2.1 and 3.2.3 of the Phase I RFI Work Plan (CH2M HILL, 2006).

3.2 MEC Avoidance/Escort

Where MEC is known or suspected to occur and no clearance activities have been completed, unexploded ordnance (UXO) Technician support for MEC avoidance will be provided. MEC avoidance techniques are steps implemented by a UXO diver/escort to avoid any potential surface or subsurface MEC; subsurface avoidance will be performed during any intrusive operations.

Activities requiring MEC avoidance and/or escort activities include, but are not limited to, transect layout and post-detonation sampling.

3.3 MEC Investigation and Removal Operations

As discussed in **Section 1.5**, sources of the geophysical anomalies detected during the October 2006 DGM effort may have shifted or may no longer be present as a result of tidal action and wave movement. As a result, the intrusive investigation of the suspected underwater demolition areas will include a "detect-and-dig" technique along representative transects within the area, in which an anomaly is investigated immediately after detection. The underwater investigation areas are shown in **Figure 3-1**.

3.3.1 Diving Operations

Diving operations will be conducted in accordance with the project Dive Operations Plan (provided in **Appendix C**), Occupational Safety and Health Administration 29 Code of Federal Regulations (CFR) 1910, Occupational Safety and Health Requirements; Naval Facilities Engineering Service Center (NFESC)'s *Naval Engineering Training and Operating Procedure and Standard (NETOPS) #4-Dive Safety*, U.S. Army Corps of Engineers' *Engineer Manual (EM) 385-1-1, Safety and Health Requirements* (U.S. Army Corps of Engineers, 2008), *U.S. Navy Diving Manual* (U.S. Navy, 2008), and USA Environmental, Incorporated (USAE)'s *Safe Diving Practices Manual* (USAE, 2008). USAE's accepted *Safe Diving Practices Manual*, U.S. Navy Dive Tables, and the project Dive Operations Plan will be kept in hardcopy form for reference or review by the dive team.

The project Dive Operations Plan (**Appendix C**) describes the duties of onsite dive team members, the diving equipment and platform, the nature of work to be performed (including tools and materials to be handled), anticipated surface and underwater conditions (visibility, temperature, currents, etc.), maximum single dive bottom times for the planned depth of dive for each diver, and the topside support for the dive team. The Dive Operations Plan also specifies the content of pre-dive conferences and required attendees, maintenance of dive logs for each diver, hazardous energy control procedures, dive flag procedures, and the frequency and extent of diving and emergency/first-aid equipment checks.

SCUBA gear utilized for the diving operations will not have any effect or interference on the all metals detector, as divers will be separated 5 feet from front to back and the head of the instrument is located approximately three feet from the SCUBA gear.

All diving operations will meet the required elements of the NFESC Diving Operation Quality Assurance Checklist (**Appendix C**).

3.3.2 UXO Personnel

All UXO personnel assigned to the project will meet or exceed the qualifications as provided in Department of Defense (DoD) Explosives Safety Board (DDESB) Technical Paper (TP) 18, *Minimum Qualifications for UXO Technicians and Personnel* (DDESB, 2004). Additionally, all UXO personnel conducting underwater detection and identification of munitions must have completed both the basic and the underwater portions of Naval School Explosive Ordnance Disposal (NAVSCOLEOD) (or foreign equivalent) training. In accordance with EM 385-1-1, documentation will also be provided for dive team members of at least four qualification working dives, using similar decompression and diving techniques and equipment as in the contract. At least one of the four qualification dives must have been completed within the last 6 months prior to the contract award date.

The dive team will consist of at least five personnel: a Diving Supervisor/UXO Technician III, one tender/UXO Technician II, two diver/UXO Technicians II, and one standby diver/UXO Technician II.

Key UXO personnel are as follows:

Diving Supervisor/UXO Technician III

Reports directly to the SM on issues pertaining to operations. The Diving Supervisor/UXO Technician III coordinates and oversees all UXO and diving operations in accordance with the requirements of the Work Plan, Dive Operations Plan, and site-specific HSP (**Appendix B**).

UXOSO/UXOQCS

Responsibilities include, but are not limited to, the following:

- Implements the MEC-related QC provisions of the project
- Conducts QC inspections of all MEC-related operations for compliance with established procedures
- Directs and approves all corrective actions to ensure that all MEC-related work complies with contractual requirements
- Implements the site-specific HSP, including MEC-related and general safety components
- Reports independently of project management to the CH2M HILL Corporate MR Safety and QC Officer
- Analyzes operational risks, hazards, and safety requirements
- Enforces personnel limits and safety exclusion zones (EZs) for MEC intrusive operations
- Conducts safety inspections to confirm compliance with safety requirements

3.3.3 Transect Layout

Transects will be parallel to one another and will run in a north-south direction with 60-foot spacing. Transects will be established by employing a handheld GPS unit to place jackstay lines that extend from the high-tide mark seaward. The line will be held in place on the bottom by anchor weights as needed and will be marked by a buoy at its seaward end. The diver will search 3 feet on each side of the jackstay line, establishing a 6-foot search lane. Four corner points of each investigation area will be identified by buoys, connected to anchor points on the seafloor. Divers will ensure that neither weighted clumps nor corner anchor points are placed on top of proud or buried MEC/MPPEH items.

Transects will be marked in ten-foot increments along the length of each transect in accordance with typical U.S. Navy diving techniques (i.e. one wrap of black tape every 10 feet and one wrap of red tape at 50-foot increments).

3.3.4 "Detect-and-Dig"

In order to locate subsurface munitions items for intrusive investigation CH2M HILL intends to use Whites Dual Pro PI underwater all-metals detectors (or equivalent).

The standard Whites Dual Pro PI system consists of a single-coil oval search head, a telescopic handle, audio headset, and processing electronics and batteries. The Whites Dual Pro PI transmitter generates a pulsed primary magnetic field, which then induces eddy currents in nearby metallic objects. The Whites Dual Pro PI is capable of detecting ferrous and non-ferrous items. Audio output from the device will be observed by a UXO-qualified diver/operator to detect, in real time, ferrous and non-ferrous items on and beneath the surface of seafloor sediments. The sound frequency is relative to the amplitude of the response of the system. The diver will listen to the audible sound output by the system to identify anomaly locations. While maintaining neutral buoyancy and while swimming close to the bottom, divers will conduct the visual and subsurface investigation along the transect lines previous laid down. Divers will sweep their metal detector in front of them so that coverage extends three feet on either side of the transect centerline. Once an anomaly is identified, the diver will intrusively investigate the anomaly using the methods described in **Section 3.3.5**. At stopping points, the divers will tie flagging ribbon on the transect line prior to stopping or surfacing. The flagging ribbon will be removed prior to continuing the investigation.

The "detect-and-dig" process will be conducted along the planned transects shown on **Figure 3-2** through **Figure 3-4.** Because wave action and tidal movement may have affected the final resting place of MEC/MPPEH, the historical underwater demolition areas have been expanded for the investigation. The investigation area at each suspected underwater demolition area is based on the historically identified area, plus 50 feet to the east and west and 50 feet seaward. It also extends to the high tide mark on the landward side. The planned transect design is based on 10 percent coverage of the investigation areas.

As part of the QC process, 10 percent of the transects will be re-inspected by the UXO QC Specialist (UXOQCS) to confirm that all anomalies were detected. The locations checked will be distributed in a randomly selected, spatially representative sample across each investigation area.

3.3.5 Manual Excavation of Anomalies

Excavation of individual geophysical anomalies will be performed by UXO-qualified divers using hand-excavation tools. The UXO team performing this work will be composed of qualified UXO Technician IIs, or higher, supervised by a Diving Supervisor/UXO Technician III.

Small hand tools, such as shovels, spades, trowels, and pry bars, will be used to access potential MEC/MPPEH. Hand tools will be used for most of the items, which generally are expected to be found near the surface of the seafloor sediments. The following basic techniques will be used for anomaly excavation:

- For all anomalies identified by the "detect-and-dig" technique, the source of the anomaly will be investigated.
- Until identified otherwise, the anomaly is assumed to be MEC. Excavation will be initiated adjacent to the subsurface anomaly. The excavation will continue until the excavated area has reached a depth below the top of the anomaly as determined by frequent inspection with the handheld all-metals detector (Whites Dual Pro PI or comparable).
- Using small tools to carefully remove the sediments from the side of the anomaly, the diver will expose the anomaly source for inspection and identification without moving or disturbing the item.
- Once the item is exposed for inspection, the excavation team will determine whether the item is MEC/MPPEH. Divers will be in direct communication with the dive support team through the use of Ocean Technologies Systems (OTS) through water communications gear. The dive team will identify an item through consultation with the SUXOS and UXOSO/UXOQCS. The UXOSO/UXOQCS (or equivalent) will provide the final classification as to whether MEC/MPPEH is safe to move.
- Recording MEC/MPPEH: The diver will communicate to the MRSIMS operator in the dive support team via OTS through water communications the item size, type, hazards, depth, orientation, the approximate location along the transect (using the 10- and 50-ft marked transect lines), etc.
- If the item is MEC/MPPEH, it will be handled as discussed below in Section 3.4
- If the item is not MEC/MPPEH, it will be removed and the area will be rechecked with a Whites Dual Pro PI or equivalent to ensure that an MEC item was not hidden beneath the removed item.

The maximum depth of intrusive investigation will be 1 foot below the surface of the seafloor sediments, based on the types of munitions used and the underwater environment. If the source of an anomaly is found to be deeper than 1 foot, the anomaly identifier and location will be recorded as having a source deeper than 1 foot beneath the seafloor that was not characterized or removed A 3-inch diameter washer that has been spray painted orange and tied with flagging ribbon will be placed where an anomaly is detected deeper than 1 foot beneath the seafloor, and will be left at the location until the UXOQCS completes QC inspection.

3.3.6 Transfer of MEC/MPPEH

Safe–to-move MEC, MPPEH, and other debris items will be hand-carried or floated on a water craft to a terrestrial processing location on Piñeros Island. MEC, MPPEH, and other debris will be segregated before transport and will remain segregated during transport. Transportation of MEC/MPPEH is described in Section 3.4.3.

3.4 Procedures for Reporting and Disposing of MEC and MPPEH Items

This section discusses the procedures for reporting and disposing of MEC and MPPEH items encountered during the project, including the responsibilities of personnel, overall safety precautions, onsite transportation of MEC, the collection point, data reporting, and demolition operations. All safe–to-move MEC/MPPEH will be demilitarized by controlled detonation procedures as necessary.

3.4.1 Responsibilities of Personnel

The general responsibilities of project personnel are described in Section 2.1.2 of the Phase I RFI Work Plan (CH2M HILL, 2006). Additional dive personnel responsibilities are described in the Dive Operations Plan (**Appendix C)**.

3.4.2 Overall Safety Precautions

Qualified UXO personnel will demolish all safe–to-move MEC items at a terrestrial processing location on Piñeros Island using controlled detonation procedures, by countercharging these items with an explosive donor charge and detonating the donor charge. Demolition will be performed by a team consisting of one UXO Technician III as the Demolition Supervisor and two UXO Technician II personnel, with the SUXOS –qualified SM responsible for the operation. UXO personnel involved in the storage and handling of demolitions will be certified in accordance with OPNAV Instruction 8023.24B, *Navy Personnel Ammunition and Explosives Handling Qualification and Certification Program* (Department of the Navy, 2010). The MPPEH storage container will be equipped with grounding for lightning protection.

3.4.3 Onsite Transportation of MEC

Safe–to-move MEC items will be hand-carried or floated on a water craft to a land-based location on Piñeros Island. The MEC transportation watercraft will contain only the MEC and no occupants. It will only be used as a MEC transfer device that is hand floated from the location of discovery to the closest collection point. Other single-person watercraft may be used to assist in the controlled movement of the floating item to ensure secure and controlled movements. It is anticipated that a floating raft with high- visibility colors may be used to float Safe-to-move items to shore for processing.

3.4.4 Collection Point

If, while performing investigations, safe-to-move MEC/MPPEH is discovered, it will be transported to a collection point on the closest beach or on the South Bunker Trail on Piñeros Island. The collection point is described in the ESS (CH2M HILL, 2010d). The items will be temporarily stored until donor explosives can be procured. Donor explosives will not be stored onsite and will be used on the date of delivery.

3.4.5 Disposition of MEC and MPPEH

If MEC is discovered that is not safe to move, as determined by the UXOSO/UXOQCS, the item will be left in place and a temporary buoy will be floated above marking the location. Item coordinates, descriptions, and photographs will be logged. MEC/MPPEH that is not safe to move will be left in place and a determination on the final disposition will be made in conjunction with the Navy.

MEC that is deemed safe to move will be transported (as discussed in **Section 3.4.3** to the closest collection point. While awaiting delivery of the explosives, the recovered MEC item will be guarded when the investigation team is not onsite in a position to monitor the item.

3.4.6 Data Reporting

Data reporting for each metallic anomaly will be performed in accordance with Sections 3.4 and 3.7 of the Phase I RFI Work Plan (CH2M HILL, 2006).

3.4.7 Exclusion Zones and Separation Distance

The 66-mm M72A2 LAW rocket is the munition with the greatest fragmentation distance (MGFD). The explosive safety quantity distance (ESQD) arcs and EZs for intentional and unintentional detonations are based on this MGFD for operations on land and above water (**Table 3-1**) and 25 pounds net explosive weight (NEW) in water (**Table 3-2**). ESQD arcs for operations on land and above water are shown on **Figure 3-5**. The EZ for swimmers, snorkelers, or divers in water, 1,299 ft (433 yards), is shown in **Figure 3-6**. The EZ for boats underway, 288 feet (96 yards) is shown on **Figure 3-7**.

TABLE 3-1
Exclusion Zones on Land and Above Water

MGFDs		EZs (feet)(above water)				
		Fragmentation Effects		Blast Overpressure Effects		
Description	Net Explosive Weight (NEW) (lb)	HFD	MFD	K328	K40	K24
66-mm M7A2 (LAW) Rocket	0.67	71(1)	420(1)	300(1)	37(1)	22(1)
Intentional Detonation + donor explosives 1 lb NEW	1.764(2)	71	420	397(3)	48(3)	29(3)

Notes:

1. DDESB, Fragmentation Data Review Form, Updated 24 May 2011
2. TNT equivalents
3. Calculated using $D=KW^{1/3}$

TABLE 3-2
Exclusion Zones in Water

MGFD					EZs (in water)
Description	Net Explosive Weight (NEW) (lb)	Water Depth (feet)	Depth of bottom/ item (feet)	Swimmer depth (feet)	Safe Range for Swimmer/snorkeler/ diver (feet)1
66-mm M7A2 (LAW) Rocket	0.67	0-30	0-30	1	288 (96 yd)
				5	582 (194 yd)
				10	801 (267 yd)
				20	1,089 (363 yd)
				30	1,299 (433 yd)

Notes:

1. Navy EODB 60A-1-1-37: Technical Manual Explosive Ordnance Disposal Procedures Underwater Ordnance Operations, Small Risk Injury Tables for a NEW up to 25 lbs.

The minimum separation distance to protect non-essential personnel from unintentional detonations during intrusive operations on land and above water is 71 feet (HFD), as shown in **Table 3-3**. The team separation distance (TSD) for unintentional detonations on land and above water is 37 feet, as shown in **Table 3-3**.

ESQD arcs, EZs, and TSDs, are taken from the ESS, subject to NOSSA approval.

If, during the course of this project, a MEC item with a greater fragmentation range than the MGFD is encountered or an item with a NEW greater than 25 pounds is encountered, work will stop, the ESQD arcs will be adjusted, and the ESS (CH2M HILL, 2010d) and Work Plan will be amended.

TABLE 3-3
Controlling EZs

Operation	Sited as	EZ	Basis(1)	ESQD (feet)
Manual operations, above water	Unintentional detonation	UXO Teams	K40 of the MGFD above water	37(2)
Manual operations, above water	Unintentional detonation	Public and non-essential personnel	HFD of the MGFD above water	71(2)
Manual operations in water (4)	Unintentional detonation	UXO Teams in Water	Safe Horizontal Distance for swimmer/snorkeler/diver	1,299 (433 yd) (4)
Manual operations in water (4)	Unintentional detonation	UXO Teams in Boat	Safe Horizontal Distance	288 (96 yd)(4)
Manual operations in water (4)	Unintentional detonation	Public and non-essential personnel (swimmer/diver/snorkeler)	Safe Horizontal Distance for swimmer/snorkeler/diver	1,299 (433 yd) (4))

TABLE 3-3
Controlling EZs

Operation	Sited as	EZ	Basis[1]	ESQD (feet)
Manual operations in water (4)	Unintentional detonation	Public and non-essential personnel (boat underway/in Transit)	Safe Horizontal Distance	288 (96 yd)(4)
Land-based MEC treatment up to 1.764 lbs of TNT equivalent NEW	Intentional detonation	Public and all personnel	MFD of the MGFD above water	420(2)(5)(6)
Land-based MPPEH storage not to exceed 10 lbs NEW	Unintentional detonation	Non-essential personnel in the open	HFD of the MGFD above water	474(7)

Notes:

1. MGFD is the 66-mm M7A2 (LAW) Rocket.
2. DDESB, Fragmentation Data Review Form, Updated 26 April 2011
3. Manual operations involve investigating anomalies with hand tools.
4. Navy EODB 60A-1-1-37: Technical Manual Explosive Ordnance Disposal Procedures Underwater Ordnance Operations, Small Risk Injury Tables for a NEW up to 25 lbs.
5. This distance can be reduced by employing engineering controls authorized by DDESB Technical Paper (TP) 16, Methods for Predicting Primary Fragmentation Characteristics (DDESB, 2009).
6. The maximum NEW for which blast overpressure (K328) does not exceed the MFD of the MGFD.
7. Naval Sea Systems Command (NAVSEA) Ordnance Pamphlet (OP) - 5 Volume 1 Eighth Revision Table 7-9 (10 lb NEW for Open)

3.4.8 Access to Exclusion Zone

Only essential project personnel and authorized visitors will be allowed within the EZ during intrusive and demolition operations. The maximum extents of the operational EZs are shown on Figures 3-5 through 3-7.

The UXOSO will be responsible for conducting an operational risk management assessment in accordance with Office of the Chief of Naval Operations Instruction 3500.39 (2010) prior to initiating response actions involving MEC at the site. In addition, the UXOSO will determine the maximum number of persons (essential personnel and authorized visitors) that can be in the EZ at one time. The ratio of UXO-qualified escorts to visitors will be determined by the UXOSO based on this site-specific operational risk analysis. Based on the risk posed by the MR operation underway, the UXOSO may decide that access to the EZ is unsafe for visitors. However, every effort will be made to accommodate the authorized visitor’s needs.

With concurrence of the Project Manager, the UXOSO will grant EZ access to authorized visitors, including representatives of the United States Environmental Protection Agency (USEPA), the Puerto Rico Environmental Quality Board (EQB), and other regulatory agencies. Access to the site will be based upon the operational risk analysis of the scheduled MEC operations and availability of escorts, as well as a demonstrated visitor need and subsequent completion of visitor safety briefings.

Persons requiring access to the EZ must demonstrate a legitimate need for access and obtain authorization from the responsible project manager and UXOSO. At a minimum, the request for authorization will include: names of the individual requesting access, the identification of emergency contacts for these individuals, purpose of visit; task(s) to be performed; and rationale to support EZ access. Persons requesting access will submit their request to the Project Manager and UXOSO prior to the proposed date of the site visit. This advance notice will allow time for the UXOSO to support the visit request by assigning a qualified escort, conducting an operational risk analysis on the operations planned for the date of the site visit, and preparing a visitor site-specific safety briefing for the planned operations.

Prior to entry, all authorized visitors will receive a site-specific safety briefing describing the specific hazards and safety procedures to be followed within the EZ for operations underway that work day. Each authorized visitor will be required to acknowledge receipt of this briefing in writing.

Authorized visitors to the EZ will be escorted at all times by a UXO-qualified person. Any authorized visitor who violates the established safety procedures will be immediately escorted out of the EZ and/or site for his or her own protection and to protect essential personnel working at the site.

3.4.9 Anomaly Tracking using MRS Information Management System

Because of the physical restrictions of underwater investigation, the individual locations of anomalies will not be recorded. For MEC/ MPPEH items, a buoy will be placed at to the item location, and surface coordinates using a real time kinematic DGPS or handheld GPS to 5-meter accuracy will be recorded. For non-MEC/MPPEH items (i.e., cultural debris), the number of anomalies will be recorded per 100-foot or smaller segment of each transect.

The MRS information management system (MRSIMS) will be used to digitally capture, track, and create automated reports on:

- Project information (e.g. personnel, teams, instrument serial numbers, transect IDs and locations)
- Field Team Leader Notes (e.g. safety meetings, logbooks, field requests to management)
- UXO Field Team notes (e.g. transects, files, personnel, methods, instruments, MEC Items found)
- Transect Statuses (e.g. activities performed by transect and by acre, percents and quantities complete or remaining)
- Demolition Tracking (All MEC items noted as needing demolition or demilitarization tracked from initial discovery to final disposition)
- QC (e.g., QC on notes, intrusive investigation results and field activities)

MRSIMS operates in a multi-contractor-capable environment with tools for digital data capture, storage, analysis, QC, and rapid display to a web-based interface. The result is a near "real-time" turnaround of project data to the management team. Field operations data is captured using GPS-enabled handheld devices running mobile, forms-based software. The data are transferred to and validated within a centralized relational database.

Specific examples of data to be tracked in MRSIMS include:

- Organization name (performing the excavation)
- Team chief full name
- Depth to item—Depth from the seafloor to the top of the item in inches; also depth of water in which the item was found
- Easting coordinate
- Northing coordinate
- Orientation—geographical direction (N, S, E, W) to which the item is pointing, unless vertical
- Type—Type of ordnance, as specific as possible
- Filler—Type of filler, such as none, inert, high explosive, white phosphorus, illumination, incendiary, chemical, or smoke
- Fuze—Type of fuze, such as none, inert, point detonating, powder train, or base detonating
- Date found—Date on which the MEC item was found
- Disposal—Disposal status (e.g., blown in place)
- Date Disposed—Date on which the MEC item was disposed
- Comments—Any comments or notes

3.5 MPPEH and Other Debris Disposition

3.5.1 Inspection and Segregation

A systematic approach will be used for collecting, inspecting, and segregating site debris. The approach is designed so that materials undergo continual evaluation/inspection from the time they are acquired until the time they are removed from the site. Site debris will be classified and segregated into one of following categories:

- MEC
- MPPEH
- Other debris

Segregation procedures begin at the time the metal item is discovered by the UXO-qualified diver. At this point, the UXO-qualified diver makes a preliminary determination as to the classification of the item:

- If the item is not munitions-related debris (other debris), it is placed at a temporary non-MPPEH debris accumulation point located within the current transect.
- If the item is identified as MPPEH, it is placed in a temporary MPPEH accumulation point located within the current transect. The divers will mark the location along the transect where the investigation stopped (with flagging ribbon) and will then swim the item to the accumulation point together.

- If the item is identified as MEC, the item will be marked by buoy. If the UXOSO/ UXOQCS determines that it is safe to move, the item will be hand-carried or floated by watercraft to a land-based collection point (as described in **Sections 3.4.3** and **3.4.4**). If the item cannot be moved, the location of the item will be documented.

3.5.2 Inspection, Certification, and Verification

The dive team will collect the scrap piles deposited in the suspected underwater demolition areas and perform an initial inspection before transport to confirm that segregation of the items according to proper classification has occurred. After transport to the MPPEH collection point on the nearest beach or inland on the South Bunker Trail on Piñeros Island, the MPPEH items will be inspected and subdivided into the following groups:

- MPPEH (3X) items and munitions debris (MD) (5X) items that require treatment/demilitarization
- MD (5X) items that do not require further demilitarization

Items identified as 3X and items identified as 5X still requiring demilitarization will be hand-carried or floated to the nearest beach on Piñeros Island. There they will be treated or demilitarized, while 5X items not requiring demilitarization will be certified by the SM/SUXOS, verified by the UXOSO/UXOQCS, and moved to the MPPEH collection point shown on **Figure 3-5.**

Two scrap metal containers will be positioned at the MPPEH collection point and will remain locked when not in active use. One container will be marked "Other Debris (0X)" and will be used to collect non-munitions-related metal debris that is moved from the suspected underwater demolition areas.

The other container will be marked "MPPEH-Safe (5X)" to indicate the explosives safety status of the contents. An explosives safety status of "safe" means that the contents have been certified and verified as not presenting an explosion hazard, and are consequently safe for unrestricted transfer or release pending any further demilitarization requirements or trade security controls. Material that has been certified and verified safe is no longer considered MPPEH, provided the chain of custody remains intact. An authorization letter (per paragraph 13-15.7 of OP 5, *Ammunition and Explosives Ashore,* Revision 8 [NAVSEA, 2009]) from the Project Manager (PM) to the Commanding Officer of the cognizant Facilities and Engineering Command, stating that the specific project personnel are qualified and authorized to sign a certification of MPPEH as safe or hazardous for the site, will be on file at the site.

MPPEH that cannot be certified and verified as safe will be categorized as 3X and will remain at the collection point until treated or demilitarized by controlled detonation procedures.

All MPPEH inspections, certifications, and verifications will be conducted in accordance with the requirements of DoD Instruction (DoDI) 4160.21-M (Chapter 4, Paragraph B) (DoD, 1997) and OP 5 Volume 1, Chapters 13-15 (NAVSEA, 2009)). Demilitarization, if necessary, will be conducted in accordance with DoD 4160.21-M-1.

CH2M HILL will confirm that all material is properly inspected by UXO-qualified personnel. The SM/SUXOS will certify that the 5X containers are free of explosive hazards. The UXOSO/UXOQCS (per OP 5, Section 13-15.7.2) will verify that the 5X containers are free of explosive hazards. DD Form 1348-1A will be used as certification/verification documentation. All DD Form 1348-1A forms will clearly show the following information in typed or printed letters:

1. Name of CH2M HILL's SM/SUXOS
2. Organization
3. Signatures
4. CH2M HILL's home office
5. Field office phone number(s) of the persons certifying and verifying the scrap metal

For scrap metal, the DD Form 1348-1A will clearly indicate the following:

1. Basic material content (type of metal, for example, steel or mixed)
2. Estimated weight
3. Unique identification of each sealed container
4. Location where MPPEH was obtained
5. Seal identification, if different from the unique identification of the sealed container

As part of the transfer of MPPEH-safe (5X) material for final disposition, the following certification/verification will be entered on each DD Form 1348-1A and will be signed by the SM/SUXOS and the UXOQC:

> *This certifies and verifies that the material potentially presenting an explosive hazard has been 100 percent properly inspected and to the best of our knowledge and belief, is inert and/or free of explosives or related materials.*

CH2M HILL will arrange for maintaining the chain of custody and final disposition of the certified and verified materials. The certified and verified material will be released only to an organization that will:

1. Provide signed documentation stating that the organization has received the containers; that each container has an unbroken seal and unique identification; and that after reviewing the documentation accompanying the containers, agrees that the sealed containers contained no explosive hazards when received. This documentation will be signed on company letterhead and state that the contents of these sealed containers will not be sold, traded, or otherwise given to another party until the contents have been smelted and are identifiable only by their basic content.

2. Send notification and supporting documentation to the generating contractor (CH2M HILL) documenting that the sealed containers have been smelted and are now identifiable only by their basic content. These documents will be incorporated into the final report.

3.6 Field Sampling Plan

During this field effort, surface soil samples will be collected from locations where MEC demolition occurs to evaluate the presence of residual MCs. *Addendum No.1- Terrestrial Intrusive Investigation Work Plan* (CH2M HILL, 2010a) provides a detailed description of sampling, QC, and SOPs to be followed for post-detonation soil sampling.

3.7 Assessment of UW-4

During the field effort, water conditions and the presence of recreational users at site UW-4 will be periodically observed to aid in further evaluation of potential threats resulting from possible historical military use of this area.

VICINITY MAP

LEGEND

Planned Underwater Investigation Area

Suspected Former Underwater Demolition Area

N

0 300 600

Feet

FIGURE 3-1
Planned Underwater Investigation Areas

Phase I RCRA RFI

Piñeros and Cabeza de Perro Islands

Naval Activity Puerto Rico

VICINITY MAP

LEGEND

- UW Corner Points
- Planned Underwater Investigation Area
- Planned Underwater Transect
- UW1-T## Planned Underwater Transect Label

Notes:
1. Transect Lanes are 6 feet wide
2. Spacing between transects 57 feet
3. Corner Coordinates:
   NAD 983 StatePlane Puerto Rico Virgin Islands
   FIPS 5200 Feet

UW-1	Easting	Northing
Northwest Corner	945358.43	810787.91
Northeast Corner	945867.87	810811.81
Southeast Corner	945905.40	810011.82
Southwest Corner	945383.74	810248.50

N

0 60 120
Feet

FIGURE 3-2
Planned Underwater Transects: UW-1
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

VICINITY MAP

LEGEND

- UW Corner Points
- Planned Underwater Investigation Area
- Planned Underwater Transect
- UW2-T## Planned Underwater Transect Label

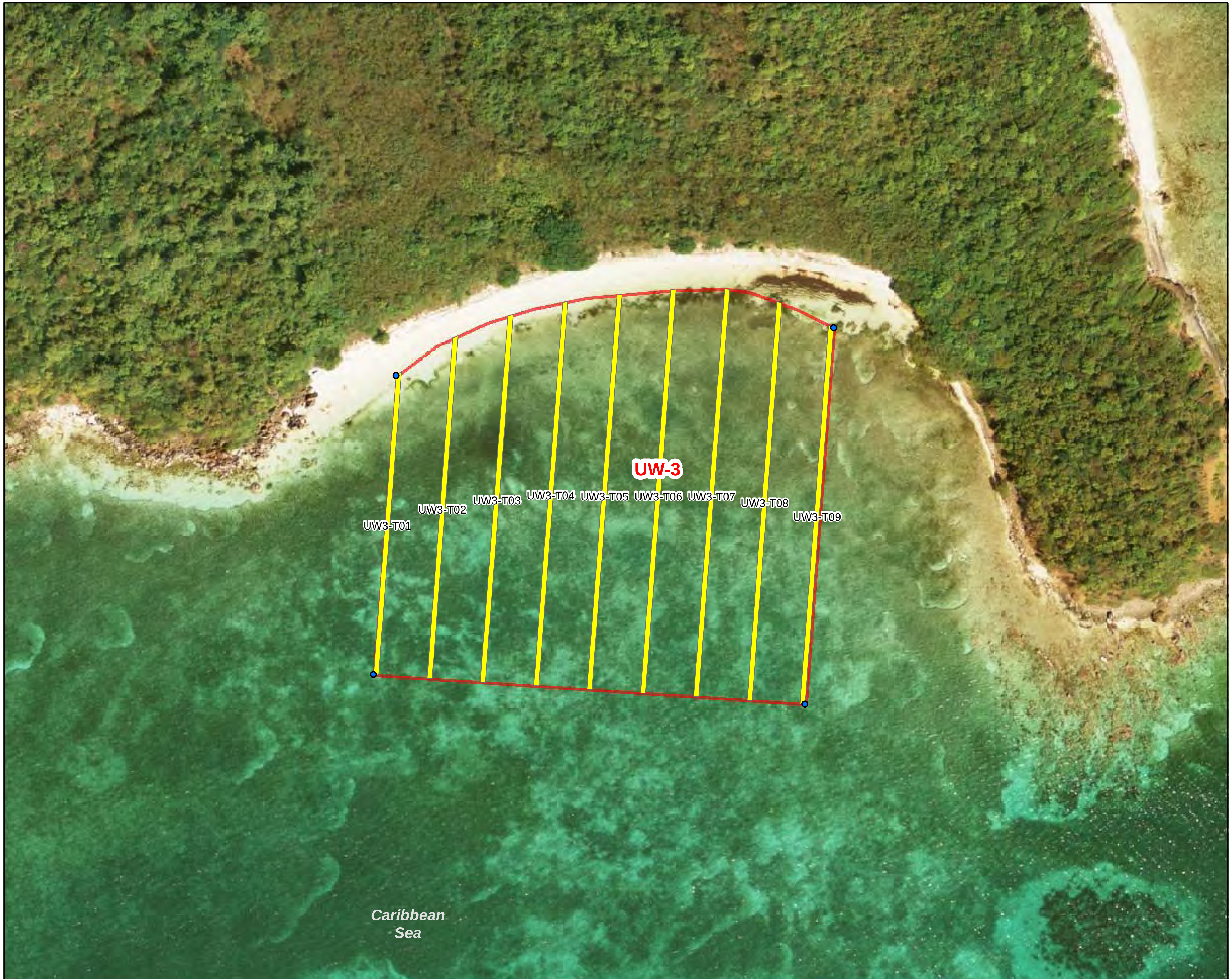
Notes:
1. Transect Lanes are 6 feet wide
2. Spacing between transects 57 feet
3. Corner Coordinates:
   NAD 983 StatePlane Puerto Rico Virgin Islands
   FIPS 5200 Feet

UW-2	Easting	Northing
Northwest Corner	949434.84	810347.91
Northeast Corner	948915.74	810317.36
Southeast Corner	949478.96	809598.29
Southwest Corner	948957.11	809614.43

N

0 60 120
Feet

FIGURE 3-3
Planned Underwater Transects: UW-2
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico



VICINITY MAP

LEGEND

- UW Corner Points
- Planned Underwater Investigation Area
- Planned Underwater Transect
- UW1-T## Planned Underwater Transect Label

Notes:
1. Transect Lanes are 6 feet wide
2. Spacing between transects 57 feet
3. Corner Coordinates:
   NAD 983 StatePlane Puerto Rico Virgin Islands
   FIPS 5200 Feet

UW-3	Easting	Northing
Northwest Corner	950434.86	806909.49
Northeast Corner	950459.80	807277.56
Southeast Corner	950975.12	807338.81
Southwest Corner	950943.69	806875.01

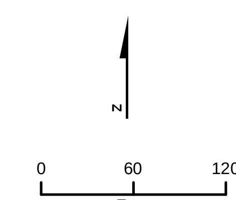


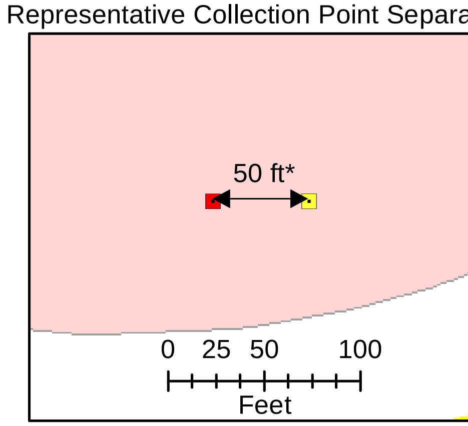
FIGURE 3-4
Planned Underwater Transects: UW-3
Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

VICINITY MAP

LEGEND

- Controlled Detonation Area
- MPPEH Collection Point
- Non-MPPEH Collection Point
- South Bunker Trail
- EZ For MPPEH Storage Area PTR - 300 Feet
- EZ For MPPEH Storage Area IBD - 474 Feet
- EZ For Unintentional Detonation (HFD) - 71 Feet
- EZ For Intentional Detonation Without Engineering Controls - 420 Feet
- Planned Underwater Investigation Area
- Suspected Former Underwater Demolition Areas

Representative Collection Point Separation



*Minimum distance separation to be maintained at each MRS.

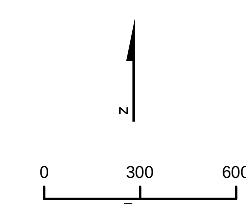


FIGURE 3-5
ESQD on Land and Above Water for MRS
Piñeros Island
Puerto Rico

VICINITY MAP

LEGEND

- Safe Horizontal Distance for Swimmer\Snorkeler\Diver[1] - UW-1
- Safe Horizontal Distance for Swimmer\Snorkeler\Diver[1] - UW-2
- Safe Horizontal Distance for Swimmer\Snorkeler\Diver[1] - UW-3
- Planned Underwater Investigation Area
- Suspected Former Underwater Demolition Area

[1] Based on Small Risk Injury, 25 lbs NEW, Swimmer Depth 30 ft (Navy EODB 60A-1-1-37)

N

0 1,250 2,500
Feet

FIGURE 3-6
ESQD Swimmer\Snorkeler\Diver in Water for MRS
Piñeros Island
Puerto Rico

VICINITY MAP

LEGEND

- Safe Horizontal Distance for Boats Underway/In Transit[1] - UW-1
- Safe Horizontal Distance for Boats Underway/In Transit[1] - UW-2
- Safe Horizontal Distance for Boats Underway/In Transit[1] - UW-3
- Planned Underwater Investigation Area
- Suspected Former Underwater Demolition Area

[1] Based on Small Risk Injury, 25 lbs NEW, Swimmer Depth 1 ft (Navy EODB 60A-1-1-37)

N

0 1,250 2,500
Feet

FIGURE 3-7
ESQD for Boats Underway for MRS
Piñeros Island
Puerto Rico

CH2MHILL

SECTION 4

Quality Control Plan

4.1 Introduction

Updates to the QCP are presented in this section; see the Phase I RFI Work Plan (CH2M HILL, 2006) for the complete QCP.

4.2 Project Organization and Responsibilities

4.2.1 Project Team Members

Senior MR Technical Consultant

The Senior MR Technical Consultant for this project is Tim Garretson. The Senior MR Technical Consultant is a company-wide resource with significant experience in the various technical aspects involved in a complex project. The Senior MR Technical Consultant reviews all documents and procedures for technical validity and adherence to CH2M HILL policy. The Senior MR Technical Consultant is responsible for evaluating the technical merit of the work planning documents before field activities begin, and reviewing all deliverables before submittal to NAVFAC and NAPR. The Senior MR Technical Consultant assists the PM in selecting an internal quality assurance/quality control (QA/QC) review team, coordinating review efforts, addressing review comments, and resolving technical issues.

Environmental Information Specialist

The Environmental Information Specialist (EIS) for this project is TBD. The EIS is responsible for the structure, organization, format, implementation, and operation of the project database, as described in the Phase I RFI Work Plan (CH2M HILL, 2006). The EIS provides a point of communication between the laboratory and the project team, supervises the analytical data quality evaluation, and participates in preparing deliverables to the client. The EIS is also responsible for monitoring project-specific laboratory activities, including checking laboratory invoices and reports. The EIS also supervises the data management team and provides direction to the database manager.

Site Manager

The SM for this project is TBD. The SM reports to the PM and is responsible for coordinating field efforts; providing and maintaining sampling equipment and materials; providing shipping and packing materials; and accurately completing the field logbook. The SM will supervise the completion of all chain-of-custody records and the proper handling and shipping of samples. As the lead field representative, the SM is also responsible for ensuring the consistent implementation of project QA/QC measures at the site and for ensuring that field activities are performed in accordance with approved work plans, policies, and field procedures.

The SM for this project will also serve as the Site Safety Coordinator (SSC). The SSC implements the project-specific HSP (**Appendix B**) in the field. The SSC will assist in conducting site briefings and ensure that all final safety checks are performed. The SSC is responsible for stopping any investigation-related operation that threatens the health and safety of the field team or surrounding populace.

Subcontractors

The following services will be provided by subcontractors:

- Site support (charter boats to provide transportation and serve as dive platforms)
- MEC support, including MEC avoidance, intrusive investigation, MEC demolition, and MPPEH segregation and disposal
- Laboratory analyses

Procurement of subcontractors will be performed in accordance with the Navy CLEAN Contract Procurement Manual.

4.2.2 Project Communication

No updates have been made to **Section 4.2.2.**

4.3 Environmental Investigation QA Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required from field and laboratory data collection activities to support decisions concerning risk and remediation. DQOs are established before data collection begins and describe what data are needed, why the data are needed, and how the data will be used to address the problems being investigated. DQOs help to ensure that all data collected are legally and scientifically defensible. None of the DQOs have changed from those presented in the Phase I RFI Work Plan (CH2M HILL, 2006). Refer to Section 4.3 of the Phase I RFI Work Plan for all environmental investigation QA information.

To meet the requirements established by the Navy since 2006 to institute the Uniform Federal Policy-Sampling and Analysis Plan process, Addendum No. 1 of the Work Plan (CH2M HILL, 2010a) presents the MC Sampling and Analysis Plan “crosswalk table” and associated documents.

4.4 MEC-related QA Objectives

The MEC-related QA objectives from the Phase I RFI Work Plan (CH2M HILL, 2006) have changed, with the addition of MEC intrusive investigation as a work task. DQOs for the MEC intrusive investigation are defined in Table 4-1.

4.4.1 Instrument QC Procedures

Confirmation that the Whites Dual Pro PI system is operating in accordance with industry standards will be through QC tests listed in **Table 4-2** and detailed in the following text.

1. **Equipment Warm-up**. Whites Dual Pro PI instruments will be warmed up for a minimum of 5 minutes. Equipment warm-up will be performed the first time an instrument is turned on for the day or has been turned off for a sufficient amount of time for the specific instrument to cool down.

2. **Personnel Test.** This test checks the response of instruments to personnel and their clothing/proximity to the system. On a daily basis, the instrument coils for those instruments being used that day will be checked for their response to the personnel operating the system. The response will be observed in the field for immediate corrective action. The personnel test will be conducted at the beginning of the survey operation for each work day.
3. **Static Background and Static Spike.** Static tests are performed by positioning the survey equipment in an area free of metallic contacts and collecting data for a specific period, while holding the instrument in a fixed position with nothing near the coils, and then with a "spike", a small industry standard object (ISO) (**Figure 4-1**), placed underneath approximately 3 feet of water. The Whites Dual Pro PI operator will test the equipment underwater at approximately 2 feet above the bottom.

TABLE 4-2
Whites Dual Pro PI QC Tests and Acceptance Criteria

Test	Test Description		Power on	Beginning of day	Beginning and end of day
1	Equipment Warm-up	5 minutes	X		
2	Personnel Test	Based on instrument used. Personnel, clothing, etc., should have no effect on instrument response.		X	
3	Static Background and Static Spike	Strong audio response over item, lack of audio response over background			X

The purpose of the static test is to determine whether unusual levels of instrument or ambient noise exist and that the instrument is responding as it should. The instrument should produce a strong audio response to the industry standard object.

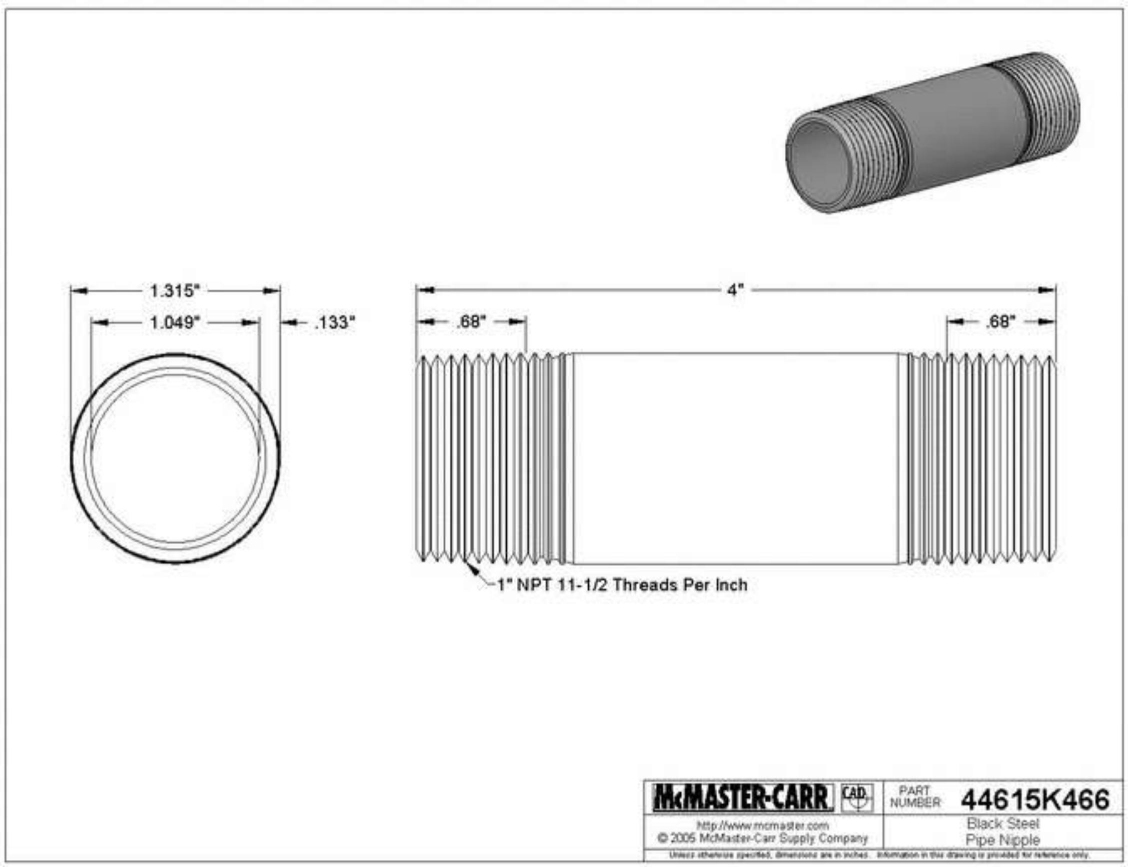
The static background and static spike test are conducted at the beginning and end of each survey operation. This is the test that essentially "opens" and "closes" out a survey operation.

4.4.2 Transect QC Procedures

1. **10% Re-inspection of Transects:** As a continuing part of the QC process, 10 percent of each transect will be re-inspected by the UXOQCS to confirm that all anomalies were detected. The locations checked will be distributed in a randomly selected, spatially representative sample across each transect. Transect lines will remain in place until the QC re-inspection is completed and approved by the UXOQCS. (It is anticipated that the transect lines will remain undisturbed for the duration of the investigation at each underwater area. If this is not the case, more frequent QC inspection may be performed.) If anomalies one foot or less are identified in the re-inspected area, the transect will fail QC and will be re-investigated by the UXO divers, following root cause analysis.

2. **QC Seeding:** the UXOQCS will place one seed item per transect per diver as part of the QC process to evaluate the effectiveness of the intrusive investigation process. The seed item will be an ISO painted fluorescent orange (or equivalent). The seed item will be placed on the surface of the seafloor or no greater than one foot below the seafloor at a frequency of one seed item per transect per diver. UXO Divers will not be provided the location of the seed items. If the UXO Divers do not recover the seed item(s) for each transect, the transect will fail QC and will be re-investigated by the UXO divers, following root cause analysis.

FIGURE 4-1
Industry Standard Object



4.4.3 Definable Features of Work and the Three-Phase Control Process

MEC-related QC will be monitored through the definable features of work (DFOWs) using a three-phase control process. The DFOWs and the three-phase control process are discussed in the following subsections.

Definable Features of Work

The DFOWs for this project are divided into activities related to planning, field operations, and final project reports and closeout:

1. **Planning**
   - Pre-Mobilization Activities
   - Technical Project Planning
   - ESS Development and Approval
2. **Field Operations**
   - Mobilization
   - MEC Intrusive Investigation
   - Demobilization
3. **Final Project Reports and Closeout**
   - Final Reports
   - Archiving
   - Project Closeout

Three Phases of Control

The Corporate MR Safety and QC Officer is responsible for ensuring that the three-phase control process, including the preparatory phase, initial phase, and follow-up phase, is implemented for each DFOW listed in this QCP.

Each control phase is important for obtaining a quality product and meeting the project objectives; however, the preparatory and initial audits are particularly valuable in preventing problems. Production work is not to be performed on a DFOW until successful preparatory and initial phases have been completed.

Preparatory Phase. The preparatory phase culminates with the planning and design process leading up to actual field activities. Successful completion of the preparatory phase verifies that the project delivery, QC, and safety plans have been completed. The following actions will be performed as applicable for each DFOW:

1. Confirm that the appropriate technical procedures are incorporated into the project work plan and review procedures.
2. Confirm that adequate testing is called for to ensure quality delivery.
3. Confirm definition of preliminary work required at the work site and examine the work area to confirm required preliminary work has been properly completed.
4. Confirm availability of required materials and equipment. Examine materials and equipment to confirm compliance with approved submittals and procedures. Ensure equipment testing procedures are in place, with control limits and frequency, for each piece of equipment.
5. Confirm the qualifications/training of personnel and verify that roles/responsibilities are well-defined and communicated.

6. Confirm with the Health and Safety Manager (HSM) that the site-specific HSP adequately addresses the work operations and that applicable safety requirements have been incorporated into the plan.
7. Discuss methods to be employed during the field activities.
8. Confirm any required permits and other regulatory requirements are met.
9. Verify that lessons learned during previous similar work have been incorporated as appropriate into the project procedures to prevent recurrence of past problems.

Project personnel must correct or resolve discrepancies between existing conditions and the approved plans/procedures identified by the PM, Corporate MR Safety and QC Officer, and the team during the preparatory phase. The PM or designee must verify that unsatisfactory and nonconforming conditions have been corrected before granting approval to begin work.

Results of the activity are to be documented in the Preparatory Inspection Checklist (Appendix D, Form 4-1b) specific for the DFOW and summarized in the weekly QC report.

Initial Phase. The initial phase occurs at the startup of field activities associated with a specific DFOW. The initial phase confirms that this QCP, other applicable work plan sections, and procedures are being effectively implemented and the desired results are being achieved.

During the initial phase, the initial segment of the DFOW is observed and inspected to ensure that the work complies with contract and work plan requirements. The initial phase should be repeated if acceptable levels of specified quality are not met. The following shall be performed for each DFOW:

1. The SM will make the field teams aware of expectations associated with the field methods established under the preparatory phase by observing the initial work activities and interacting with the PM and responsible subcontractors' supervisors.
2. Resolve conflicts. The Senior MR Technical Consultant will guide the PM and responsible supervisor(s) in resolving conflicts. Should conflicts arise in establishing the baseline quality for the DFOW, the responsibility to resolve the conflict falls to the PM. Should the conflict not be resolved in a manner that satisfies the project requirements, the Senior MR Technical Consultant must elevate the conflict to the program level (that is, the Program QC Manager) and issue a non-conformance report. The Senior MR Technical Consultant may direct a cessation of work activity with the concurrence of the Program QC Manager should the issue jeopardize the results of the DFOW or put the project at risk of non-conformance.
3. Verify with the HSM that the site-specific HSP was developed to ensure that the identified hazard assessments adequately address field conditions. Confirm that applicable safety requirements are being implemented during field activities.

Upon completion of initial phase activities, the results are to be documented in the Initial Phase Inspection Checklist (Appendix D, Form 4-2b) and the QC logbook and summarized in the weekly QC report. Should results be unsatisfactory, the initial phase will be rescheduled and performed again.

Follow-up Phase. Completion of the initial phase of QC activity leads directly into the follow-up phase, which addresses the routine day-to-day activities at the site. Inspection and audit activities associated with each DFOW are addressed in Section 4.4.2 of the Phase I RFI Work Plan (CH2M HILL, 2006). Specific concerns associated with the follow-up phase include:

1. Inspection of the work activity to ensure work complies with the contract and work plans.
2. Evaluation and confirmation that the quality of work is being maintained at least at the level established during the initial phase.
3. Evaluation and confirmation that required testing is being performed in accordance with the procedures in this Work Plan Addendum.
4. Confirmation that nonconforming work is being corrected promptly and in accordance with the direction provided by the PM, SM, Senior MR Technical Consultant, or Corporate MR Safety and QC Officer.

To conduct and document these inspections, the SM is to generate the Follow-up Phase Inspection Checklist (Appendix D, Form 4-3b). The follow-up phase inspections will be performed daily or as otherwise identified in this QCP until the completion of each DFOW.

The SM is responsible for onsite monitoring of the practices and operations taking place and verifying continued compliance with the specifications and requirements of the contract, project, and approved project plans and procedures. The SM is also responsible for verifying that a daily health and safety inspection is performed and documented, as prescribed in the HSP (Attachment B of **Appendix B**). Discrepancies between site practices and approved plans and procedures are to be resolved and corrective actions for unsatisfactory and nonconforming conditions or practices are to be verified by the SM or a designee before granting approval to continue work. Follow-up phase inspection results are to be documented in the QC logbook and summarized in the weekly QC report.

Additional Audits. Additional audits performed on the same DFOW may be required at the discretion of the Program QC Officer, Senior MR Technical Consultant, Corporate MR Safety and QC Officer, HSM, or the PM. Additional preparatory and initial audits are generally warranted under any of the following conditions: unsatisfactory work, changes in key personnel, resumption of work after a substantial period of inactivity (for example, 2 weeks or more), or changes to the project scope of work/specifications.

Final Acceptance Audit. Upon conclusion of the DFOW and prior to closeout, the Final Acceptance Inspection, a documentation review exercise, must be performed to verify that project requirements relevant to the work are satisfied. Outstanding and nonconforming items are to be documented on the Final Inspection Checklist (**Appendix D**). Resolution of each item must be noted on the checklist. Contractor acceptance and closeout of each definable work feature is a prerequisite to project closeout.

4.4.4 Audit Procedures

The Corporate MR Safety and QC Officer is responsible for verifying compliance with this QCP through audits and surveillance. The PM or a designee is to inspect/audit the quality of work being performed for the DFOW. The PM or a designee is to verify that procedures conform to applicable specifications stated in this Work Plan Addendum or other applicable guidance. Identified deficiencies are to be communicated to the responsible individual and documented in the QC logbook and weekly QC report. Corrective actions are to be verified by the Corporate MR Safety & QC Officer and recorded in the weekly QC report.

The specific QC audit procedures for the DFOWs, including the phase during which it is performed, the frequency of performance, the pass/fail criteria, and actions to take if failure occurs, are presented in **Table 4-3**.

The Inspection Schedule and Tracking Form (Appendix D, Form 4-5b) is to be used by the Corporate MR Safety and QC Officer for planning, scheduling, and tracking the progress of audits for this project. The information on the form is to be kept up to date and reviewed by the Corporate MR Safety and QC Officer for planning purposes. Audit activities and corrective actions are to be documented by the Corporate MR Safety and QC Officer in accordance with this chapter. Audit records are to be maintained as part of the project QC file.

4.4.5 Corrective/Preventive Action Procedures

The corrective and preventive action procedures are designed to prevent quality problems and to facilitate process improvements, as well as identify, document, and track deficiencies until corrective action has been verified.

Preventive Measures

Although the entire QC program is directed toward problem prevention, certain elements of the program have greater potential to be proactive. The primary tools for problem prevention on this project are discussed in **Section 4.4.2**, **Section 4.4.6**, and **Section 4.4.7**. Should these preventive measures fail, tracking and communicating deficiencies provide a mechanism for preventing their recurrence.

Continual Improvement

Project personnel at all levels are encouraged to provide recommendations for improvements in established work processes and techniques. The intent is to identify activities that are compliant but can be performed in more efficiently or cost-effectively. Typical quality improvement recommendations include identifying an existing practice that should be improved and/or recommending an alternate practice that provides a benefit without compromising prescribed standards of quality. Project staff members are to bring their recommendations to the attention of project management or the QC staff through verbal or written means. However, deviations from established protocols are not to be implemented without prior written approval by the PM and concurrence of the Senior MR Technical Consultant. Where a staff-initiated recommendation results in a tangible benefit to the project, public acknowledgment is to be given by the PM.

Deficiency Identification and Resolution

While deficiency identification and resolution occurs primarily at the operational level, QC audits provide a backup mechanism to address problems that either are not identified or cannot be resolved at the operational level. Through implementation of the audit program prescribed in this QCP, the QC staff is responsible for verifying that deficiencies are identified, documented as prescribed herein, and corrected in a timely manner. Deficiencies identified by the QC staff are to be corrected by the operational staff and documented by the QC staff.

Corrective Action Request

A Corrective Action Request (CAR) (Appendix D, Form 4-6b) can be issued by any member of the project staff, including CH2M HILL and subcontractor employees. If the individual issuing the CAR is also responsible for correcting the problem, then that individual should do so and document the results on Part B of the CAR (Appendix D, Form 4-6b). Otherwise, the CAR should be forwarded to the PM, who is then responsible for evaluating the validity of the request, formulating a resolution and prevention strategy, assigning personnel and resources, and specifying and enforcing a schedule for corrective actions. Once a corrective action has been completed, the CAR and supporting information are to be forwarded to the Corporate MR Safety and QC Officer for closure. Sufficient information is to be provided to allow the QC reviewer to verify the effectiveness of the corrective actions.

In addition to observing actual work operations, CARs are to be reviewed during follow-up QC audits. The purposes of this review are as follows: to document that established protocols are implemented properly; to verify that corrective action commitments are met; to document that corrective actions are effective in resolving problems; to identify trends within and among similar work units; and to facilitate system root cause analysis of larger problems. Particular attention is to be given by the QC staff to work units that generate either an unusually large or unusually small number of CARs.

The PM will determine whether a written Corrective Action Plan (CAP) (Appendix D, Form 4-7b) is necessary, based on whether or not any of the following are met: the CAR priority is high; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent recurrence. The CAP is developed by a PM designee and approved and signed by the PM. The CAP is to indicate whether it is submitted for informational purposes or for review and approval. In either event, the operational staff members are encouraged to discuss the corrective action strategy with the QC staff throughout the process.

Deficiency and Corrective Action Tracking

Each CAR must be given a unique identification number and tracked until corrective actions have been taken and documented in Part B of the form and the CAR is submitted to the PM or a designee for verification and closure.

Lessons Learned and Other Documentation

The lessons learned through the deficiency management process are documented on CARs and CAPs. To share the lessons learned, these documents can be submitted to the client through a weekly QC report summarizing the week's QC activities and including a grouping of the daily QC reports (Appendix D, Form 4-8b) and all other pertinent reports created during the week.

CARs should be cited in the weekly QC report. Minor deficiencies identified during a QC audit that are readily correctable and can be verified in the field are to be documented in the QC logbook and weekly QC report without initiating a CAR. Deficiencies that cannot be readily corrected are to be documented by the QC staff on a CAR and in the weekly QC report. Copies of CARs are to be referenced in and attached to the weekly QC report. CAPs will also be attached to weekly QC reports to document the final outcome of the deficiency. Similar or related deficiencies may be addressed on a single CAP.

4.4.6 Records Generated

Onsite Project File

The SM will establish and maintain an onsite project file in accordance with the CH2M HILL corporate quality manual for document control. The onsite files will be maintained in the project field office or designated field vehicle. The purpose of these files is to maintain a complete set of all documents, reports, certifications, and other records that provide information on project plans, contractual agreements, and project activities.

The CH2M HILL MRSIMS, which consists of a mobile field data collection device used to collect form-based information of MEC and DGM operations and a centralized desktop interface and database, will be the repository for most of the information collected by the field team (e.g., daily reports). This database will contain information that can be easily presented and delivered through automated report production, which reduces the amount of actual paper in the files. The database will be backed-up daily and stored in an offsite location. The files (in either paper or digital format) will include copies of the following:

- Qualifications and training records of all site personnel
- Submittals
- Schedule and progress reports
- Survey records
- Conversation logs
- Meeting minutes and agenda
- Audit logs and schedules
- Photo documentation
- Site charts
- Equipment check records
- Nonconformance and corrective action reports
- Daily work activity summary reports, which may include:
  - Weekly QC report
  - Daily health and safety report
  - Daily report (including activity log)
  - Daily MEC team logs
  - Daily DGM team logs
  - Reports on any emergency response actions (EOD will handle emergencies on this project)
  - Equipment check records
  - Chain-of-custody records

- Incident reports
- Truck load tickets and shipping papers (if applicable)

As the project activities progress, the SM will monitor the usefulness of the project filing system for information retrieval. If additional file sections are needed, the SM will expand the initial filing structure to include additional sections.

Weekly QC Report

The SM is responsible for preparing and submitting the weekly QC report to the Program QC Officer for the project file and providing concurrent courtesy copies to the PM. The weekly QC report, with attachments, is to be submitted to the Program QC Officer on the first workday following the dates covered by the report.

The weekly QC report is to provide an overview of QC activities performed each day, including those performed by subcontractors. The QC reports must present an accurate and complete picture of QC activities by reporting both conforming and deficient conditions, and the reports should be precise, factual, legible, and objective. Copies of supporting documentation, such as checklists and surveillance reports, are to be attached.

A field QC log is to be maintained by the SM to document details of field activities during QC monitoring activities. At the end of each day, copies of the log entries are to be attached to the weekly QC report. The information in the field QC log provides backup information and is intended to serve as a phone log and memory aid in the preparation of the weekly QC report and for addressing follow-up questions.

QC and health and safety staff input for the weekly QC report is to be provided in writing to the SM at a previously agreed upon time and place, generally no later than 1 hour before normal close of business. For the sake of simplicity and completeness, the format for QC staff input should follow the same format as the weekly QC report with only the relevant sections completed.

Copies of weekly QC reports with attachments and field QC logs no longer in use are to be maintained in the project QC file. Upon project closeout, all QC logs are to be included in the project QC file.

4.4.7 Submittal Management

The PM is responsible for overall management and control of project submittals. The PM is also responsible for submittal scheduling and tracking.

The PM is responsible for verifying, through detailed review, that submittals as well as the materials and the work they represent, are in full compliance with applicable contractual specifications and the project plans. The PM is also responsible for confirming that a project file is established and maintained and that project documents are retained and controlled appropriately.

Review of Plans and Specifications

During the preparatory phase of control for a DFOW, the PM is responsible for reviewing the plans and, when necessary, requesting clarification from the project team. The primary purpose of this review is to identify and resolve potential conflicts before initiating work operations.

Review and Approval of Submittals

The Senior MR Technical Consultant and the PM must review submittals prepared by CH2M HILL and subcontractors for completeness and compliance with the specifications of the project and contract. Non-compliant submittals are to be returned to the originator for corrective action and re-submittal to the PM or his designee.

Before submittal to the Senior MR Technical Consultant for certification, technical documents such as reports and plans are to be reviewed by qualified staff members. Although part of the QC process, technical reviewers may include, but are not limited to, the QC staff.

For each project document that is submitted for technical review, a Document Review and Release Form (Appendix D, Form 4-9b) is to be initiated by the author, submitted with the document to be reviewed, and used to document and track the review process. A copy of the completed Document Review and Release Form is to be submitted to the PM together with the corrected document for his review and certification. Each document is to provide a signature block for PM and Senior MR Technical Consultant certification. Original Document Review and Release Forms, reviewer comments, and annotated versions are to be retained with the deliverable in the project file and reviewed by the QC staff during project audits.

4.4.8 Personnel Qualifications and Training

All project staff members will be qualified to perform their assigned jobs in accordance with the terms outlined in the contract and by the project plans. Specific qualifications and training required for UXO-qualified personnel, in accordance with DDESB TP 18, (DDESB, 2004) are stated in the following subsections.

Documentation of Qualification and Training for UXO-qualified Personnel

The SM will maintain records documenting the required qualifications, training, and certifications for each site worker. The SM will monitor expiration dates to provide advance warning to the PM of when employees will require refresher training or other renewals. The Corporate MR Safety and QC Officer will maintain records of site-specific and routine training for personnel and visitors, as required by these project plans. These records will be maintained onsite for audit purposes.

All UXO Personnel

All MEC personnel will comply with the training requirements specified by the Program QC Manager. UXO personnel including the Corporate MR Safety & QC Officer will be graduates of one of the following schools or courses:

- U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland
- U.S. Naval EOD School, Indian Head, Maryland
- U.S. Naval EOD School, Eglin Air Force Base, Florida
- DoD -certified equivalent course (UXO Technician I only)

EOD experience in National Guard or reserve units will be based on the actual documented time spent on active duty, not on the total time of service.

Diver/UXO Technician II

UXO-qualified divers /UXO Technicians II will have completed both the basic and underwater portions of NAVSCOLEOD (or foreign equivalent) training. In addition they will be able to:

- Conduct visual and/or detector-aided MEC field search activities
- Locate subsurface MEC by operating geophysical detection instruments and related equipment
- Perform field maintenance and tests on geophysical detection instruments and related equipment
- Remove non-hazardous MD and range-related debris, only after such items have been inspected by a UXO technician or UXO-qualified personnel and determined to be safe for handling
- Perform site and area security functions
- Reconnoiter and classify MEC
- Identify all types of military munitions, including possible fuzes and their condition, armed or unarmed; examples are the following:
  - Bombs
  - Guided missiles
  - Projectiles
  - Rockets
  - Land mines and associated components
  - Pyrotechnic items
  - Military explosives and demolition materials
  - Grenades
  - Submunitions
- Operate personnel decontamination stations
- Determine precise locations in the field environment, using a variety of techniques such as global positioning equipment or basic land navigation using topographical map and compass
- Perform field-expedient identification procedures to identify contaminated soil
- Perform limited technical supervision of UXO sweep personnel
- Escort personnel who are not directly involved in UXO-related operations (e.g., personnel performing environmental monitoring), but who have activities to perform within exclusion zones
- Inspect MPPEH for the presence of explosive safety hazards

Tender/UXO Technician II

The Tender/UXO Technician II will able to perform all functions of the Diver/UXO Technician II.

Diving Supervisor/UXO Technician III

In addition to being able to perform all functions of the Diver/UXO Technician II listed in this section, the Diving Supervisor/UXO Technician III may:

- Coordinate and oversee all diving operations
- Supervise and perform the onsite demolition of MEC and handle demolition materials
- Prepare required MR actions administrative reports
- Prepare SOPs for onsite MR activities
- Conduct daily site safety briefings
- Supervise the conduct of all onsite MEC-related operations
- Inspect and certify and/or verify MPPEH as safe or as to the explosive hazard it may present for transfer within DoD or release from DoD control in accordance with current policies and standards.

UXOSO/UXOQCS

In addition to being able to perform all functions of the diver/UXO Technicians II, and Diving Supervisor/UXO Technician III listed in this section, a UXOSO/UXOQCS may:

- Develop and implement the MEC-specific sections of this QCP for all explosives-related operations
- Conduct daily audits of the procedures used by MEC teams and individuals for processing MPPEH
- Perform and document random sampling (by pieces, volume, or area) of all MPPEH collected from the various teams to ensure that no items with explosive hazards, engine fluids, illuminating dials, or other visible liquid hazardous or toxic waste materials are identified as MD or range-related debris as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A
- Conduct QC audits of all explosives operations for compliance with established procedures
- Identify and verify completion of all corrective actions to ensure that all explosives operations comply with requirements
- Develop and implement an approved explosives and MEC S&H program in compliance with applicable requirements, whether federal, state, or local
- Analyze operational risks, explosive hazards, and safety requirements
- Establish and enforce compliance with all site-specific explosives operations safety requirements

- Enforce personnel limits and safety EZs for explosives-related operations
- Conduct, document, and report the results of safety inspections to achieve compliance with all applicable explosives safety policies, standards, regulations, and codes
- Ensure that all protective works and equipment used within the EZ are operated in compliance with applicable DoD policy, NOSSA approvals, and other federal, state, and local health and safety statutes, regulations, and codes

SM

In addition to being able to perform the functions of the UXO Technicians II, and III, the SUXOS-qualified SM will:

- Plan, coordinate, and supervise all field operations.
- Assist in the development of MR plans.
- Supervise multiple teams, if necessary.

Corporate MR Safety and QC Officer

The Corporate MR Safety and QC Officer may:

- Develop and implement the MEC-specific sections of the QCP for all MEC-related operations
- Identify and verify completion of all corrective actions so that all MEC operations comply with requirements

4.4.9 UXO Team Composition and Roles

The dive team will consist of at least six personnel, as described in the Dive Operations Plan (**Appendix C**):

- Diving Supervisor/UXO Technician III
- UXOSO/UXOQCS
- Two divers/UXO Technicians II;
- One standby diver/UXO Technician II
- One tender/UXO Technician II

For all terrestrial demolition operations, the Diving Supervisor/UXO Technician III will supervise all MEC operations and personnel operating within an EZ.

Health and Safety Training

Health and safety training requirements for onsite project personnel have been established in accordance with Occupational Safety and Health Act/Occupational Safety and Health Administration requirements for hazardous site workers (29 CFR 1910.120) and are specified in the HSP (**Appendix B**). These training requirements must be met before project personnel can begin site work.

4.4.10 Testing and Maintenance

Testing and maintenance of equipment such as geophysical instruments, radios, cell phones, vehicles, and machinery will be performed in accordance with the manufacturer’s specifications, this Work Plan Addendum, and all applicable SOPs.

Test results must be documented by the individual performing the test. Testing and maintenance records associated with the measuring and testing of equipment must be generated by the individual performing the activity. Documentation for testing and maintenance of equipment is to be made available to the client upon request.

The SM is responsible for ensuring that the tests are performed and that the results are summarized and provided with the weekly QC report. To track each failing test for future retesting, the failing test must be noted on the deficiency log. Resolution of the failing test is complete when retesting is performed and the corrective action is verified on the deficiency log.

TABLE 4-1
Data Quality Objectives for MEC Intrusive Investigation

Step	DQO
1. State the problem.	There is a potential for MEC to be present in the underwater investigation areas UW-1, UW-2, UW-3, and UW-4.
2. Identify the decisions.	Are anomalies detected by geophysical instruments caused by subsurface MEC?
3. Identify inputs to the decisions.	Anomalies identified by Mag and Dig intrusive operations QC data
4. Define the boundaries of the study.	The boundaries of the underwater investigation areas (UW-1, UW-2, UW-3) with a 50 foot expansion to allow for possible wave/tidal movement; the intrusive investigation will consist of 6 meter-wide transects paced a maximum of 60 feet apart on centers, and will cover at least 10% of the MRS. A transect spacing of 60 ft will provide a 6 ft "footprint" (within which metallic items will be detected), resulting in a 10% coverage of each underwater area. Depth of investigation will be up to 1 foot below the sea floor.
5. Develop a decision rule.	Intrusive Investigation will be considered complete when the following criteria have been met: 1) All subsurface anomalies identified along transects are investigated so that the nature of anomalies across each underwater investigation area can be characterized. The number of investigated anomalies will be tracked and itemized by category (MEC, MPPEH, other debris, no contact, deeper than 1 foot). MEC items will be located using handheld GPS. MPPEH items will be itemized and located along 50-foot interval of transects. 2) Any MEC/MPPEH found is disposed via detonation and MDAS is certified using DD Form 1348-1A and shipped offsite for disposal.
6. Specify tolerable limits on decision errors.	Decision errors will be minimized by utilizing qualified and experienced personnel, appropriate instrumentation and QC procedures (QC seeding and re-inspection) described in this work plan.
7. Optimize the design for obtaining data.	The design is optimized by intrusively investigating all anomalies encountered. The intrusive investigation process is optimized by using qualified and experienced personnel to perform the investigation and implement appropriate QC procedures.

TABLE 4-3
Definable Features of Work Auditing Procedures
Addendum 2 – Underwater Investigation, Work Plan to Conduct Phase I RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure[2]	QC Phase[3]	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Planning						
Geographical Information System (GIS) Setup (Pre-mobilization Activities)	Project GIS Manager	Verify GIS system has been set up and is ready for site data.	PP	O	GIS system has been set up and is ready for site data.	Do not proceed with field activities until criterion is passed.
Document management and control (Pre-mobilization Activities)	Project Manager	Verify appropriate measures are in place to manage and control project documents.	PP	O	Appropriate measures are in place to manage and control project documents.	Do not proceed with field activities until criterion is passed.
Data Management (Pre-mobilization Activities)	Project Manager	Verify appropriate measures are in place to manage and control project data.	PP	O	Appropriate measures are in place to manage and control project data.	Do not proceed with field activities until criterion is passed.
Subcontracting (Pre-mobilization Activities)	Project Manager, Site Manager	Verify subcontractor qualifications, training, and licenses.	PP/IP	O	Subcontractors' qualifications, training, and licenses are up to date and acceptable.	Ensure subcontractor provides the qualifications, training, and licenses or change subcontractor.
Technical and Operational approach (Technical Project Planning)	Project Manager	Verify technical and operational approaches have been agreed on by the project team.	PP/IP	O	Technical and operational approaches have been agreed on by project team and incorporated into the Work Plans.	Do not proceed with field activities until criterion is passed
Work Plan Addendum and Explosives Safety Submission (ESS) Amendment preparation and approval	Project Manager	Verify Work Plan Addendum and ESS Amendment have been prepared and approved.	PP/IP	O	Work Plan and ESS Amendment has been approved	Do not proceed with field activities (excluding site mobilization) until criterion is passed.
Field Operations						
Site preparation (Mobilization)	Project Manager	Verify local agencies are coordinated.	PP/IP	O	Local agencies are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager	Verify equipment has been inspected and tested.	PP/IP	E	Equipment passes inspection and testing.	Proceed only with activities for which equipment has passed inspection and testing.
Site preparation (Mobilization)	Project Manager	Verify communications and other logistical support requirements are coordinated.	PP/IP	O	Communications and other logistical support are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager	Verify emergency services have been coordinated.	PP/IP	O	Emergency services are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	MR Safety & QC Officer, Project Manager	Verify site-specific training is performed and acknowledged.	PP/IP	O	Site-specific training is performed and acknowledged	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	MR Safety & QC Officer, Project Manager	Hold pre-mobilization meeting and Operations Readiness Review (ORR) with the project team.	PP/IP	O	Project plans are reviewed and acknowledged by team members.	Do not proceed with field activities until criterion is passed.
Site Preparation (MEC Intrusive Investigation)	SM/SUXOS	Verify environmental controls are correct and functional.	IP/FP	O	Environmental controls are correct and functional.	Ensure that appropriate environmental controls are in place prior to proceeding with underwater investigation.
Site Preparation (MEC Intrusive Investigation)	SM/SUXOS	Verify area/boundary.	PP/IP	O	Area/boundary is marked.	Stop activities until area/boundary can be verified.
Site Preparation (MEC Intrusive Investigation)	SM/SUXOS	Verify equipment testing is performed per Section 4 of Work Plan Amendment. No.2	IP/FP	O/D	Equipment passes daily function test in equipment check area.	Repair or replace instrument.
Site Preparation (MEC Intrusive Investigation)	SM/SUXOS, MR Safety & QC Officer	Verify work methods are conducted IAW Section 4 of the Work Plan and Health and Safety Plan (Work Plan Appendix B). Survey/Sweeps Scrap Inspection Operations	IP/FP	D	Work methods are being performed IAW the Work Plan and SOPs.	Stop activities until Work Plan and SOPs are being followed and any activities not performed within compliance are re-evaluated and re-performed if necessary.

TABLE 4-3
Definable Features of Work Auditing Procedures
Addendum 2 – Underwater Investigation, Work Plan to Conduct Phase I RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure[2]	QC Phase[3]	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Detect and Dig Techniques (MEC Intrusive Investigation)	Project Manager, UXOQCS	Verify detect and dig methods conducted IAW Section 4 of the Work Plan and SOPs: Vallon MW 1630 Metal Detection Surveys	IP/FP	O/D	Survey conducted IAW Section 4 of the Work Plan and SOPs:	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.
Demobilization	Project Manager	Verify beach-based facilities support infrastructures are dismantled and shipped to appropriate location and area is returned to original condition.	FP	O	Facilities-support infrastructures are dismantled and shipped to appropriate location and site is returned to original condition.	Ensure that all support facilities are removed and that the site is returned to original condition
Final Project Reports and Closeout						
Final Report	Project Manager	Verify Final Report has been approved.	IP	O	Final Report has been approved.	Take appropriate actions to ensure Report gets approved
Archiving	GIS Manager	Verify data back-up systems are in place.	IP	O	Data back-up systems are in place	Ensure data back-up systems are in place
Project Closeout	Project Manager	Verify purchase orders have been closed out.	IP	O	Purchase orders have been closed out	Ensure purchase orders are closed out
Project Closeout	Project Manager	Verify invoices completed and approved.	IP	O	Invoices completed and approved	Ensure invoices are completed and approved

Notes:
IAW = in accordance with

QC Phase	Frequency
PP = Preparatory Phase	O = Once
IP = Initial Phase	D = Daily
FP = Follow-up Phase	W = Weekly
	E = Each occurrence

[1] The responsible person (if other than the MR Safety & QC Officer) is the individual with whom the MR Safety & QC Officer will coordinate with to ensure compliance with requirements and to verify that any necessary follow-up actions are taken.
[2] Where appropriate, a reference has been included referring the reader to a more detailed description of the procedures being audited.
[3] Documentation to be in accordance with the three-phase control process as outlined in the Quality Control Plan

SECTION 5

Explosives Management Plan

This Explosives Management Plan details the management of explosives to support the removal and disposal of MEC and MPPEH items that could possibly be discovered during the intrusive investigation activities. In the event that MEC is discovered, the UXO subcontractor will comply with this explosives management plan and follow controlled detonation procedures. This plan was developed in accordance with DID MR-005-03, Federal Acquisition Regulations Subpart 45.5, *Management of Government Property in the Possession of Subcontractors*; Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF, 1990), P 5400.7, *ATF Explosives Laws and Regulations* (DOJ, 2007), 6055.09-M, *DoD Ammunition and Explosives Safety Standards* (DoD, 2008; U.S. Department of Transportation regulations; and local and state laws and regulations including Puerto Rico's Explosives Act (Title 25, Internal Security, Subtitle 1. Generally Part V. Regulation of Firearms, Explosives, and Other Dangerous Devices. Chapter 59).

5.1 Acquisition

CH2M HILL and the UXO subcontractor maintain valid ATF permits for the purchase and use of explosives. The UXO subcontractor will be the primary point of contact for all acquisition and use of the explosives used during this project. Copies of these permits will be maintained at the project site and, upon request, will be made available to any local, state, or federal authority.

5.1.1 Description and Estimated Quantities

The types and quantities of explosives used during this intrusive investigation will be determined in consultation between CH2M HILL's SM and the UXO subcontracting company. All explosives will be supplied by an on-call vendor and will be used for demolition after MEC/MPPEH has been transported onshore to Piñeros Island. Explosives will not be stored onsite.

5.1.2 Acquisition Source

The UXO subcontractor will acquire explosives from a commercial explosives vendor who will deliver the materials directly to Naval Activity Puerto Rico (NAPR). Explosives will be transported by the UXO subcontractor to the project site on Piñeros Island, and used immediately for controlled detonation operations. Authority to order explosives will be given by the CH2M HILL SM before the UXO subcontractor orders explosives.

5.2 Initial Receipt

5.2.1 Procedures for Receipt of Explosives

The UXO subcontractor will take custody of the explosives from the vendor at NAPR and will be responsible for transporting the explosives from NAPR to Piñeros Island and verifying that the type, quantity, and lot number of each explosive item has been checked against the manifest and properly recorded.

The original receipt and shipping documents will be maintained onsite with other project records by the CH2M HILL SM.

5.2.2 Reconciling Discrepancies

Any discrepancies between the actual type and quantity of explosives received and the shipping documentation will be noted on the shipping documentation with the signatures of both the delivery driver and the individual authorized to receive the explosives. A legible copy will be filed onsite. The authorized individual receiving the explosives will immediately inform the UXOQCS and SM/SUXOS of the discrepancy. The Diving Supervisor/UXO Technician III will coordinate notification of the commercial explosives vendor.

5.3 Storage

Not applicable. Explosives will not be stored onsite.

5.4 Transportation

Explosives for demolition operations will be provided by a licensed vendor on an on-call basis. The explosives vendor will transport explosive material to the NAPR installation and will transfer them in a "day box" portable magazine to a private charter boat, which will transport the explosives to Piñeros Island.

The explosives vendor's transportation route and the transfer point are shown on Figure 5-1. The explosives vendor will enter the NAPR installation at Gate No. 3 on Bennington Drive, where he will be met by the UXO subcontractor's UXOSO and an NAPR representative. After the vendor's credentials and manifest are confirmed, he will proceed along the following route: south on Bennington Road; turn left and proceed east on Langley Drive; continue to proceed east on Marina Bypass; turn right and proceed southeast on Forrestal Drive; turn right and proceed southwest on the roadway to Pier 1 or Pier 2.

5.5 Receipt Records and Explosive Inventories

This section describes the procedures for maintaining records of explosives inventories.

5.5.1 Records Management

At the time of an explosives delivery and explosives issuance, the SM/SUXOS will ensure that all additions and subtractions from the shipment inventory are properly recorded. Explosives will be ordered on a just-in-time-for-delivery basis, and they are expected to be used immediately once onsite.

CH2M HILL will archive all explosives inventory records generated for at least 5 years in accordance with ATF regulations.

5.6 Authorized Individuals

The UXO subcontractor shall have an ATF permit to purchase, use, handle, transport, and store explosives. The UXO subcontractor's Blaster in Charge will be responsible for the proper receipt of explosives from the explosives vendor. The Blaster in Charge may specifically authorize other individuals to perform the receipt and initial inventory of the explosives, but the Blaster in Charge cannot delegate the responsibility for ensuring that the inventory, receipt, and handling of the explosives are performed in accordance with the requirements of this plan.

The CH2M HILL SUXOS-qualified SM will retain authority to approve detonation.

Any individual authorized to receive explosives will be at least a UXO Technician III and will be either a U.S. Department of Justice Employee Possessor or Responsible Person with the UXO subcontractor. Written authorization designating the personnel who can receive or use explosives will be provided by the UXO subcontractor. As the end user of explosives, the Blaster in Charge will certify in writing that the explosives were used for their intended purpose. A copy of this certification, along with all inventory records, will be provided to the CH2M HILL MR Operations Director and the UXO subcontractor's ATF permit holder.

5.7 Lost, Stolen, or Unauthorized Use of Explosives

If explosives are discovered to be lost, stolen, or used without authorization, the incident will be reported immediately to the SM/SUXOS turn will inform CH2M HILL's PM, MR Operations Manager, and the MR Market Segment Director. The CH2M HILL PM will notify the Navy Technical Representative.

As the federal permit holder, the UXO subcontractor is required by law ((27 CFR 55.30) to report the theft or loss of explosives to the ATF within 24 hours. In the event of such an occurrence, the following procedures will be followed:

- The area will be sealed until the appropriate authorities complete their investigation.
- The UXO subcontractor will make the appropriate notifications in accordance with 27 CFR 55.30, which include calling the **ATF (1-888-283-2662)** and the local law enforcement authorities.
- The UXO subcontractor is responsible for completing and forwarding ATF Form F 5400.5, *Report of Theft or Loss – Explosive Materials.* This form will be completed by the SM/SUXOS and provided to the MR Services Director, MR Operations Director, PM, and the UXOQCS. Final disposition of the form will be the responsibility of the MR Operations Director.

SECTION 6

Explosives Siting Plan

This Explosives Siting Plan provides explosives safety criteria for planning and siting explosives operations for intrusive investigation activities. This plan was prepared in accordance with DID MR-005-04. The information in this plan is consistent with the ESS for Phase I RCRA Aquatic Investigation (CH2M HILL, 2010d). NOSSA approval of the ESS will be obtained prior to the start of fieldwork.

6.1 Munitions Response Site

The 66mm M72A2 (LAW) Rocket is the MGFD for the suspected underwater demolition areas and any necessary land-based disposal actions, if required, for this operation. The ESQD arcs and EZs for intentional and unintentional detonations are based on this MGFD (**Tables 6-1 and 6-2, Figures 6-1, 6-2, and 6-3**).

TABLE 6-1
Exclusion Zone Parameters on Land and Above Water

MGFDs		EZs (feet)(above water)				
	Net Explosive Weight (NEW) (lb)	Fragmentation Effects		Blast Overpressure Effects		
Description		HFD	MFD	K328	K40	K24
66-mm M7A2 (LAW) Rocket	0.67	71(1)	420(1)	300(1)	37(1)	22(1)
Intentional Detonation + donor explosives 1 lb NEW	1.764(2)	71	420	397(3)	48(3)	29(3)

Notes:

1. DDESB, Fragmentation Data Review Form, Updated 24 April 2011
2. TNT equivalents
3. Calculated using D=KW1/3

TABLE 6-2
Exclusion Zone Parameters in Water

MGFD					EZs (in water)
Description	Net Explosive Weight (NEW) (lb)	Water Depth (feet)	Depth of bottom/ item (feet)	Swimmer depth (feet)	Safe Range for Swimmer/snorkeler/ diver (feet)[1]
66-mm M7A2 (LAW) Rocket	0.67	0-30	0-30	1	288 (96 yd)
				5	582 (194 yd)
				10	801 (267 yd)
				20	1,089 (363 yd)
				30	1,299 (433 yd)

Notes:

1. Navy EODB 60A-1-1-37: Technical Manual Explosive Ordnance Disposal Procedures Underwater Ordnance Operations, Small Risk Injury Tables for a NEW up to 25 lbs.

The minimum separation distance to protect non-essential personnel from unintentional detonations during intrusive operations is 71 feet (HFD).

The TSD for unintentional detonations is 35 feet.

ESQD arcs, EZs, and TSDs will be taken from the NOSSA-approved ESS.

If, during the course of this project, a MEC item with a greater fragmentation range than the MGFD or an item with a NEW greater than 25 lbs is encountered, work will stop, the ESQD arcs will be adjusted, and the ESS (CH2M HILL, 2010d) will be amended.

6.2 Demolition Areas

All MEC found during the course of the investigation that are safe to move will be transported to a collection point on Piñeros Island. No underwater demolition will take place. The SUXOS-qualified SM and the UXO subcontractor's Diving Supervisor/UXO Technician III will evaluate the recovered MEC/MPPEH and existing ESQD arcs to confirm that disposal by detonation can be performed safely.

6.3 MEC/MPPEH Disposal

Disposal will be conducted in accordance with Technical Manual 60A 1-1-31, EOD Disposal Procedures and OP-5 Volume I (NAVSEA, 2009). Intentional detonations involving the use of sandbags as an engineering control will not exceed 1.764 lbs. NEW (including donor charge) HD 1.1.For intentional detonations, the MSD is the distance at which both project personnel and the public will be from the detonation. The MSD for intentional detonations for this operation is 420 feet.

Before demolition operations begin, all non-essential personnel within the EZ will be evacuated from the detonation site. The appropriate local authorities will be notified of the time and place of the demolition operation. Before the demolition charges are primed, all avenues of ingress will be physically blocked by guard personnel. Radio communications will be maintained between the involved parties at all times. Upon completion of disposal operations, the disposal team's UXO Technician III and the UXOSO will inspect each disposal shot; the UXOSO will visually inspect the disposal site(s) and the UXO Technician III will stand by at a safe distance, ready to render assistance in the event of an emergency. Upon completion of this inspection and if no residual hazards have been identified, the UXO-qualified SM will authorize the resumption of site operations.

6.4 Collection Points

If safe to move MEC/MPPEH is discovered, it will be transported to a collection point on the closest beach on Piñeros Island and will be blown in place. The item will be temporarily stored and guarded until donor explosives can be procured. Donor explosives will not be storied onsite, but will be used on the date of delivery.

6.5 Consolidated Shots

Consolidated shots are not planned for this operation.

6.6 Safe Holding Areas

MEC items encountered will be left in place on the seafloor pending response by the Diving Supervisor/UXO Technician III. The location of the item will be marked via buoy.

The dive team will collect the scrap piles deposited in the suspected underwater demolition areas and will perform an initial inspection before transport to confirm that segregation of the items according to proper classification has occurred. After transport to the MPPEH collection point on the nearest beach or on the South Bunker Trail on Piñeros Island, the MPPEH items will be inspected and the MEC team will perform an inspection to confirm that segregation of the items according to proper classification has occurred.

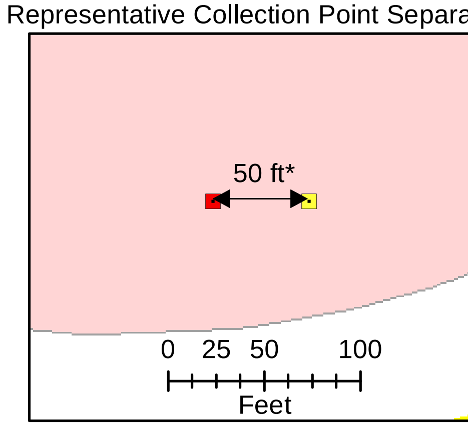
A designated secure area will be established for collecting MPPEH. This area will be locked and will have controlled access. Two scrap metal containers will be positioned as needed at the MPPEH collection points shown on **Figure 6-1** and will remain locked when not in active use. One container will be marked "Cultural Debris (0X)" and will be used to collect general metal debris that is moved from the active MRS. The other container will be marked "MPPEH-Safe (5X)" to indicate the explosives safety status of the contents.

VICINITY MAP

LEGEND

- Controlled Detonation Area
- MPPEH Collection Point
- Non-MPPEH Collection Point
- South Bunker Trail
- EZ For MPPEH Storage Area PTR - 300 Feet
- EZ For MPPEH Storage Area IBD - 474 Feet
- EZ For Unintentional Detonation (HFD) - 71 Feet
- EZ For Intentional Detonation Without Engineering Controls - 420 Feet
- Planned Underwater Investigation Area
- Suspected Former Underwater Demolition Areas

Representative Collection Point Separation



*Minimum distance separation to be maintained at each MRS.

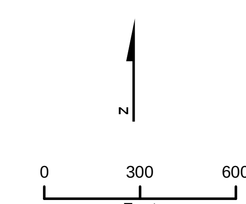


FIGURE 6-1
ESQD on Land and Above Water for MRS
Piñeros Island
Puerto Rico

CH2MHILL

LEGEND

- Safe Horizontal Distance for Swimmer\Snorkeler\Diver[1] - UW-1
- Safe Horizontal Distance for Swimmer\Snorkeler\Diver[1] - UW-2
- Safe Horizontal Distance for Swimmer\Snorkeler\Diver[1] - UW-3
- Planned Underwater Investigation Area
- Suspected Former Underwater Demolition Area

[1] Based on Small Risk Injury, 25 lbs NEW, Swimmer Depth 30 ft (Navy EODB 60A-1-1-37)

0 1,250 2,500
Feet

FIGURE 6-2
ESQD Swimmer\Snorkeler\Diver in Water for MRS
Piñeros Island
Puerto Rico

CH2MHILL

VICINITY MAP

LEGEND

- Safe Horizontal Distance for Boats Underway/In Transit[1] - UW-1
- Safe Horizontal Distance for Boats Underway/In Transit[1] - UW-2
- Safe Horizontal Distance for Boats Underway/In Transit[1] - UW-3
- Planned Underwater Investigation Area
- Suspected Former Underwater Demolition Area

[1] Based on Small Risk Injury, 25 lbs NEW, Swimmer Depth 1 ft (Navy EODB 60A-1-1-37)

N

0 1,250 2,500
Feet

FIGURE 6-3
ESQD for Boats Underway for MRS
Piñeros Island
Puerto Rico

SECTION 7

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Appendix A
Underwater Digital Geophysical Mapping Results

Underwater Digital Geophysical Mapping

Preliminary Assessment/Site Inspection

Pineros and Cabeza de Perro Islands

Naval Activity Puerto Rico

Contract Task Order 113

November 2006

Introduction

SONOGRAPHICS, INC. has completed an underwater geophysical survey in support of a Preliminary Site Assessment/Site Inspection at the Pineros and Cabeza de Perro Islands, Puerto Rico. This report describes the plan of work, the implementation of the plan and results obtained. The statement of work was issued on March 23, 2006. The following section includes the pertinent excerpts.

A. Initial Goal & Project Plan

A-1 Statement of Work Excerpts

Site Description/Background

The Department of the Navy has issued Contract Task Order (CTO) 113 to CH2M HILL to conduct a preliminary assessment/site investigation (PA/SI) to evaluate the potential presence of munitions and explosives of concern (MEC) and munitions constituents (MC) at Pineros and Cabeza de Perro Islands, located off the northeastern coast of Puerto Rico (Figure 1). The scope of the PA/SI includes the reconnaissance of four suspected underwater demolition areas offshore of Pineros and Cabeza de Perro islands (Figure 2).

The combined area of the four suspected underwater demolition areas is approximately 16 acres. Depths range from 0 to 12 meters at the three areas off of Pineros Island, and up to 30 meters at the area off of Cabeza de Perro Island. Seabed features at the underwater demolition areas are unknown, but corals and seagrass beds are known to exist in the area around the islands. Figure 3 identifies the general distribution of coral and seagrass around Pineros and Cabeza de Perro islands as presented in an environmental assessment conducted in 1992.

The objective of the underwater reconnaissance is to evaluate the potential for MEC to be present in the suspected underwater demolition areas by identifying magnetic anomalies on or shallowly buried beneath the seafloor. The assumption is made that no magnetic anomalies would be detected in the absence of MEC. Therefore, if anomalies are identified, further investigation will be conducted by CH2M HILL. These additional investigations may take the form of visual reconnaissance or recovery of the material creating the magnetic anomaly.

Task 2: Digital Geophysical Mapping

The SUBCONTRACTOR shall conduct geophysical mapping of the sea floor at the four suspected underwater demolition areas shown on Figure 2. These locations are approximate and the boundaries are not to be considered to be the exact extent of the investigation areas.

Due to the nature of this underwater investigation, CH2M HILL is not setting specific requirements concerning the detection capability of the SUBCONTRACTOR's geophysical equipment or the accuracy of the SUBCONTRACTOR's mapping. Mapping accuracy must be sufficient to allow an approximate relocation of geophysical anomalies such that a SCUBA diver with a handheld magnetometer could relocate the anomaly with a reasonable amount of effort.

It is recognized that the suspected underwater demolition area nearest Cabeza de Perro Island may exceed operational depths of the geophysical equipment. If the depths of this area may have a negative impact on the geophysical investigation, SUBCONTRACTOR shall state this in the proposal.

A-2 Proposed Procedure

The GPS will be differential or WAAS depending on required accuracy. WAAS should be sufficient to position divers with handheld units. The respective towfish will be positioned by entering the cable layback from the GPS antenna into a cable layback algorithm in the Hypack Program.

A crude bathymetric survey will be conducted first to show any hazards. The side-scan sonar survey will be conducted as a grid of parallel lines at each site with a spacing of 30 feet. The height of the sensor above the bottom will be maintained between 10 and 20 feet. The range scale will be 25 or 50 meters providing a swath of coverage of approximately 50 or 100 meters on each survey line. Dual frequency mode will be used for differential comparison between high and low frequency signatures. Where possible, an additional survey will be run perpendicular or nearly perpendicular to the first survey allowing for targets with poor aspect in the first survey to present better. The second survey will be run in high speed high frequency mode to make use of the smaller effective array length which is desirable for resolving targets in the near field of the sonar beam.

The Geometrics G882 is equipped with a depth sensor and altimeter. The depth and altitude data will be recorded with the intensity readings and towfish position. The sampling rate will be at 10 samples per second. The magnetometer signal level will be monitored to ensure optimum sensor alignment and external interference is minimized or eliminated. Volcanic substrate near the surface has been reported to cause interference on the island of Culebra. Sub-bottom surveys located areas with sediment overburden that served as a buffer and permitted magnetometer data to be taken. This condition may exist at Pineros and Cabeza in the designated areas.

The published sensitivity of the G882 is <0.004 nT/ pHz rms. Typically 0.02 nT P-P at a 0.1 second sample rate or 0.002 nT at 1 second sample rate up to 10 samples per second.

The magnetometer survey will be conducted as a grid of parallel lines at each site with a spacing of 10 feet. The height of the sensor above the bottom will be maintained between 5 and 10 feet. An optimal survey grid direction will be derived from the combination of area boundaries, bathymetry and geological interference.

Key Specifications

4200-FS Tow Fish

Frequency	120 / 410 kHz dual
Modulation	Full Spectrum chirp frequency modulated pulse with amplitude and phase weighting
Operating Range (max)	120 kHz 500 meters p/side; 410 kHz 150 meters p/side
Towing Speed (max safe)	12 knots
Towing Speed *	4.8 knots in HDM, 9.6 knots in HSM
Output Power	120 kHz 4 joules, 410 kHz 2 joules
Pulse Length	120 kHz up to 20 ms, 410 kHz up to 10 ms
Resolution Across Track	120 kHz 8 cm, 410 kHz 2 cm
Resolution Along Track	120 kHz: 2.5m @ 200 meters range, 410 kHz: 0.5m @ 100 meters range
Horizontal Beam Width (HDM)	120 kHz - 0.64°, 410 kHz - 0.3°
Horizontal Beam Width (HSM)	120 kHz - 1.26°, 410 kHz - 0.4°
Digital Link	4 MBits/sec (typical), 4 channels of side scan data + sensor data
Dynamic Range	24 Bits
Depression Angle	Tilted down 20°
Vertical Beam Width	50°
Operating Depth (meters)	2000
Operating Temperature	0°C to 45°C
Optional Sensor Port	(1) Serial - RS 232C, 9600 Baud, Bi-directional
Heading/Pitch/Roll	Heading Accuracy: < 1.5° RMS Heading Resolution: 0.1° Roll, Pitch Angle Accuracy: ± 0.4° Roll, Pitch Angle Repeatability: 0.2° Roll, Pitch Angle Resolution: 0.1°
Options	Pressure, Temperature, Magnetometer, USBL Acoustic Tracking System, Acoustic Responder, Depressor and Custom Sensors
Diameter	11.4 cm (4.5 inches)
Length	125.6 cm (49.5 inches)
Tow Fish Material	Stainless Steel
Weight in Air/Saltwater	48 / 36 kg (105 / 80 pounds)
Tow Cable Length	6,000 meters
Tow Cable Type	Co-axial

System Options

	4200P portable topside processor (see EdgeTech website for specs)

* Meets NOAA Shallow Water Survey Specification- Min 3 pings on a 1-meter target at 100 meters range.

Specifications subject to change without notice.

B. Environmental Assessment

The purchase order was issued on March 26, 2006 and plans were made to conduct the survey. Before those plans could be implemented the survey was put on hold pending approval by National Marine Fisheries Service of an Environmental Assessment Report (BA). The approval came in early October and equipment was shipped to Puerto Rico on October 12, 2006. The pertinent sections of the BA report are included as Appendix A of this document.

C. Field Activities

On October 18, 2006, the 36' vessel Coral provided by Sea Ventures, Inc. was mobilized with the EdgeTech 4200-FS Side-Scan Sonar and Trimble DSM-232 DGPS Navigation Systems. On October 19th the Navigation computer with Hypack Navigation Software was installed to interface the DGPS and output towfish coordinates to the Sonar computer. The Navigation computer was loaded with preplanned survey lines for each of the four survey areas and provided visual guidance to the helmsman for navigation of each line. The DGPS system received differential corrections from the Puerto Rico Coast Guard Beacon and was able to provide WGS 84 differential positions to the Navigation computer.

After testing all equipment and reviewing all safety checklists, the vessel sailed to the UW-4 area at Cabeza de Perro Island. Personnel aboard were, Felix Rivera, Destino Rivera and Jorge De Santiago (Master) all of Sea Ventures, Inc. and Rick Horgan of Sonographics, Inc.

C-1 Side-scan Sonar Surveys

At UW-4 preliminary runs were made while monitoring the vessels depth sounder to confirm the information already provided in the BA (25 to 35'). The Side-Scan towfish was deployed from the stern of the vessel with a measured amount of cable out. The distance from the DGPS antenna to the stern was also measured. The layback was calculated by the Navigation software enabling towfish coordinates to be sent to the Sonar computer in real time. The first side-scan survey line was started at 09:30 local time and the lines at 30' spacing were run SE/NW starting near the island and working into deeper water. Additional lines were run from NE to SW at 60' spacing. Sea condition was less than 2 feet with a swell from the northeast. While maneuvering to start lines, the wreck of a large landing craft vessel was detected just east of the area at 18degrees 15.038minutes North and 065degrees 34.470minutes West. Side-scan operations at UW-4 were completed at 11:44 on October 19th at which time the vessel departed for UW-1.

At UW-1 preliminary runs were made while monitoring the vessels depth sounder to confirm the information already provided in the BA (20 to 25'). The first side-scan survey line was started at 14:42 and the lines at 30' spacing were run E/W starting near the island and working into deeper water. The layback in the navigation computer was adjusted accordingly. Fourteen E/W lines and three north to south lines were run before survey operations were completed at 16:30 on October 19th.

Side-scan survey operations continued at UW-1 at 08:42 and were completed at 10:10 on October 20th. Felix Rivera was not aboard on this and the remaining survey days.

The vessel proceeded to UW-3 and preliminary runs were made while monitoring the vessels depth sounder to confirm the information already provided in the BA (less than 8'). It was determined that lines could only be run from west to east as there was not room to maneuver on the east side and the north edge is at the beach. The Side-scan towfish was moved to the bow to facilitate towing in shallow water and the layback was adjusted accordingly. Side-scan survey operations commenced at a 30' spacing at 11:40. A mooring buoy was observed at coordinates 950843, 807088. The survey of UW-3 was completed at 13:10 on October 20th.

The vessel proceeded to UW-2 and preliminary runs were made while monitoring the vessels depth sounder to confirm the information already provided in the BA (less than 15' with a coral mound). It was noted that shallow coral reefs intruded into the area on both the east and west sides reducing the survey area. After adjusting the layback the Side-scan survey lines were started at 14:00 and finished at 15:10 on October 20th. Lines could only be run N/S due to the reefs along the east and west sides.

C-2 Magnetometer Surveys

The Geometrics model G882 magnetometer was installed and tests were done to insure that it was interfaced and working properly. The navigation computer was output to another computer which recorded the data from the magnetometer and combined it with the NAD83, PR-5200 Puerto Rico &VI State Plane Zone 1, U.S. Survey Foot coordinates coming from the navigation computer.

The depth sensor in the magnetometer towfish was calibrated. The sampling rate was set to 10 samples per second which is it's maximum. The magnetometer signal strength was monitored as the vessel was operated at 8 points of the compass to ensure that the sensor would not be affected by an improper angle to the earths magnetic field. A test pass close to a metal navigation buoy produced a significant anomaly with no degradation in signal strength. The background noise level was normal throughout the test and it was deemed that the magnetometer was ready for survey operations. The vessel then returned to port at 17:00 on October 20th.

Magnetometer survey operations started in UW-4 at 10:20 after a weather delay on October 21st. The Coast Guard Beacon signal was weak and could not lock in. The DGPS unit was switched to WAAS differential corrections for the remainder of the survey operations. Attempts were made throughout the remainder of survey to lock in to the beacon without success. The layback was updated after the cable was adjusted to keep the towfish at approximately 10' above the bottom. The lines were run at 10' spacing in a NW\SE direction starting near the island and working toward deeper water. The towfish depth was continuously monitored and the towfish was adjusted deeper as the depth increased thus keeping it near 10' above the bottom throughout the survey. Each time the cable/towfish was adjusted the layback in the navigation computer was updated. The Magnetometer signal level was monitored throughout this and all subsequent surveys at UW-1, 2 and 3. It remained high throughout. While lining up to start some of the lines a strong anomaly was detected at the location of the shipwreck detected 2 days earlier by the Side-scan sonar. The Magnetometer survey of UW-4 was completed at 14:45 on October 21st.

The vessel proceeded to UW-3 where floats was attached to the Magnetometer towfish and cable to keep them near the surface while surveying this shallow area (less than 8'). The layback was updated and the survey started in a west to east direction with a 10' spacing at 15:02 on October 21st. An anomaly was detected at the location of the mooring buoy reported above. The survey continued until 17:40 when the vessel returned to port. The survey continued at 08:00 and was completed at 10:40 on October 22nd.

The vessel proceeded to UW-1 where the cable and towfish were adjusted to operate in 10 to 20' water depths. The layback was updated and the survey started in an E/W direction with a 10' spacing at 10:53. The towfish remained between 5 and 10' above the bottom throughout the survey. The Magnetometer survey of UW-1 was completed at 15:40 on October 22nd.

The vessel proceeded to UW-2 where the cable and towfish were adjusted to operate at 5' below the surface in compliance with the Biological Assessment. This resulted in an occasional towfish height of up to 15' above bottom. The layback was updated and the Magnetometer survey started in a N/S direction with a 20' spacing at 15:54.

The Magnetometer survey of UW-2 was completed at 17:45 on October 22nd.

D. Data Processing

D-1 Side-Scan Sonar Data

The Side-scan data was recorded in the native EdgeTech (,jsf) format on the hard drive in the Sonar Computer. It was converted to the Triton Extended Format (.xtf) by the EdgeTech Discover program which is the same program that operates the towfish and records the .jsf files. The .xtf files are read by the Triton Isis program and after adjustments and navigation smoothing an image file is created for importation to the Triton Delphmap program. Delphmap is used to assemble the sonar mosaic and exports it as a Geo-Tif file. For this project the mosaics of UW-1 to 4 were exported as NAD83, PR-5200 Puerto Rico &VI State Plane Zone 1, Meter. It was necessary to convert the Geo-Tif files to U.S. Survey foot using Mentor Software GeoTiffExamine program. Each individual sonar line was examined for possible targets and each target was compared to magnetometer target positions for possible correlation.

D-2 Magnetometer Data

The magnetometer data was recorded in the Hypack .raw files. XYZ files were extracted using the Hypack program utility. The XYZ files also include the readings from the towfish depth sensor. The depth sensor data was corrected by a scale factor in Hypack which outputs the depth with the decimal 2 place to the right so 15' would read 1500 during the surveys of UW-1, 2 and 3. The scale was set one decimal to the right in area UW-4 so 10.3' would read 103 in the area UW-4 XYZ.

Example:

The following is a sample of an XYZ file. The data in the fields separated by commas is: Easting, Northing, Intensity in nt., towfish depth (10.22 feet), time, sample number.

```
945612.57,810402.46,37899.41,1022.38,12:44:36.88,15292
945612.01,810402.46,37899.19,1018.50,12:44:36.98,15293
945611.43,810402.46,37898.97,1018.50,12:44:37.08,15294
```

The XYZ files are imported to a contouring program such as Surfer. The files are read in a profile view similar to the old magnetometer charts. Anomalies are detected in profile and compared to the contour charts and color charts. The contour and color charts (provided by Tamir Klaff of CH2M-Hill) help refine the positions of anomalies as they take into account all the data rather than just the 1 line viewed in the profile. The intensities in nano-teslas (nt) were measured in the profiles and adjusted where possible from the contour charts. The charts used for this project were 2nt per contour line and 5nt per color level in the color chart.

E. Results

E-1 Side-Scan Sonar Results

There were no significant targets in the sonar data within the survey areas. Coral heads, turtle grass, coral reefs, sand waves and ripples were observed. Mooring lines and anchors were detected outside the areas during turns and approaches to the areas. Wreckage was detected northwest of UW-1 and a shipwreck east of UW-4.

E-2 Magnetometer Results

All the areas were affected by unusual variation in the in earth's magnetic field as the background intensity varied up or down from one side of the area to the other on many lines. The Cesium Magnetometer is very tolerant of fast changing or steep gradients and individual targets stood out well against the background. Running lines at 10' spacing was difficult and many lines were rerun to fill gaps. Consequently many lines crossed over one another. There was excellent correlation of field intensity at crossover positions from line to line confirming the integrity of the magnetometer to accurately measure the field and anomalies.

A tabulation of the magnetometer targets for each area is shown in Appendix E1, 2, 3 and 4. The second column in the table starts with the intensity in nt. If the anomaly is a dipole the first number is the positive intensity and the second will be negative intensity followed by a space, the line number, underscore and the time in minutes associated with the time of start for that line.

Example: 41-34 35_47 = a dipole 41nt positive 34 nt negative at line 35 at time 47 minutes after the hour during which that line was run.

If the anomaly is a monopole the first number may be positive or negative and the line number, underscore, minutes follow. If the initial reading of the profile was a monopole and subsequent analysis of the contour or color chart indicate it is part of a dipole the missing half was inserted. If the intensity value was not readable then a question mark was inserted.

Where an anomaly is apparent on the charts but was not read from the profiles it will not have a line and time and if the intensity is not known, the word dipole is inserted.

Many of the small intensity targets do not show up on one or both of the charts.

There were no high intensity anomalies in UW-4 and only one was apparent on the color chart. UW 3 was by far the most prolific in terms of contacts. Low intensity anomalies such as those listed for UW-4 were not listed in the other areas as the more significant targets were given priority.

The contour charts are shown in Appendix F1, 2, 3 and 4

The color charts are shown in Appendix G1, 2, 3 and 4

Appendix A – Excerpts of the Biological Assessment

From section 4.2

- Site UW-1, located off the northwestern corner of Isla Piñeros, had a fairly uniform depth of 20-25 feet. The substrate consisted mainly of sand with few to no coral. Visibility and depth precluded detailed bottom snorkeling identification of the entire zone, however, 8-10 boat transects across the site revealed no change in bottom contour and no protuberances that would suggest large corals extending up from the sea floor.
- Site UW-2, located off the north central region of Isla Piñeros, had a depth of approximately 15 feet. The substrate consisted mainly of sand and turtle grass (*Thalassia testudinum*), interspersed with occasional corals. There was a small 15' x 15' mounded section of hard coral (likely lettuce coral [*Agaricia agaricites*]) along the southern border of the site; however, this sheet coral remained relatively deep with a height of less than 5 feet.

  Just outside the northwestern corner of UW-2 there was a large (40' x 40') piece of apparently dead elkhorn coral. Along with this dead coral, fire coral (*Millepora* sp.), sea fan (*Gorgonia* sp.), and sea whips (*Leptogorgonia* sp.) had colonized the area. This area had heights that were within 5 feet of the water surface and will likely need to be avoided by the towfish in its pathing into and out of the area.
- Site UW-3, located in the southeastern cove of Isla Piñeros, had a depth of less than 8 feet. The substrate was entirely sand and turtle grass. There were no coral formations in this area.
- Site UW-4, located on the northern point of Cabeza de Perro, varies from 25 feet deep along the southern edge near the island to greater than 35 feet deep along the northern edge. Weather conditions and visibility at the time of surveying were not conducive to snorkeling this area. Survey transects were conducted by boat along the edges and center of the area. The bottom contours were noted to be relatively flat with no protuberances indicative of large coral formations.

6.4.1 Potential Effects on Sea Turtles and Manatees

Three of the four areas (UW-1, UW-2, and UW-3) are near beaches (Figure 2) and have the potential for sea turtle activity. Typically this activity would be transient swimming and the sea turtles would be expected avoid the area where the investigation was active if geophysical equipment was in use. However, area UW-2 is adjacent to a coral reef and seagrass is present at area UW-3. It is possible that the MEC investigation activity would temporarily displace hawksbill and green turtles from these potential foraging areas. The MEC investigation would not result in physical intrusion into the coral reef or destruction of any seagrass, corals, sponges, or other reef organisms. During underwater operations in the vicinity of the coral mound at UW-2, the towfish will be operated no more than 5 feet below the water surface in order to avoid the coral. In areas of UW-3 where seagrass beds are located and the water depth is less than 8 feet, the towfish will be operated at a depth of no more than 5 feet below the water surface so that the seagrass beds are not disturbed. In all other areas, the towfish to be used for the underwater surveys will be kept 5-10 feet off of the ocean floor and will be operated in such a manner that it will not destroy any foraging or refuge habitats.

Appendix B – Trimble DSM-232 GPS Receiver

TRIMBLE DSM 232 MODULAR GPS RECEIVER

STANDARD SYSTEM FEATURES

- Modular receiver (separate antenna and receiver unit) for installation flexibility and security of investment
- Integrated display and keypad for system configuration and status checking without external software
- External GPS antenna choices for single frequency, dual frequency or DGPS base station operation
- IALA Beacon, Satellite Based Augmentation Systems (SBAS) such as WAAS, EGNOS compatible
- Accepts RTCM and CMR (optional) corrections from external radio link
- Upgradable to and available as 24-channel L1/L2 GPS receiver for improved accuracy performance, allowing for:
  - 3D decimeter accuracy OmniSTAR XP and HP service capable
  - 3D centimeter accuracy RTK capable
- Up to 10 Hz measurement update rate (NMEA and TSIP Protocols)
- Two physical connectors allow for 3 programmable RS-232 serial ports and 2 NMEA 2000® capable ports
- 1PPS signal
- Waterproof and dustproof
- -30° C to +65° C (-22° F to +140° F) operating temperature range
- 9V to 28V DC input power range with over-voltage protection
- Backward compatibility with DSM132 – same antenna cable, single frequency / beacon antenna, power and data cable, and mounting bolt pattern
- Suitable for permanent / semi permanent as well as short term installations

HARDWARE SPECIFICATIONS

Physical

Size (WxHxD) . . . . 14.8 cm (5.7 in) x 5.6 cm (2.2 in) x 21.6 cm (8.6 in)
Receiver Weight . . . . 0.96 kg (2.13 lb)
Keyboard and display . . . LCD backlight display 16 characters by 2 rows, 4 button keypad
Antenna Mounting . . . . All accept 5/8"-11 UNC male bolt

Environmental

Operating temperature . . . . -30° C to +65° C (-22° F to +140° F)
Storage temperature . . . . -34° C to +85° C (-29° F to +185° F)
Humidity . . . . Complies with MIL 810E. Unit sealed to +/- 5 PSID
Water . . . . Waterproof and dustproof

Electrical

Power . . . . 9V to 28V DC external power input with over-voltage protection
Power consumption . . . . Nominal 350 mA at 12 V DC
Certification . . . . Class B Part 15, 22, 24 FCC certification, CE mark approval, C-tick approval, WEEE

ANTENNA SPECIFICATIONS

DGPS Antenna

Size . . . . 15.5 cm (6.1 in) D x 14.0 cm (5.5 in) H
Weight . . . . 0.55 Kg (1.2 lb)
Operating Temperature . . . . -30°C to +65°C
Usage . . . . L1 GPS, Beacon, SBAS and L-Band

Dual Frequency Antenna

Size . . . . 16 cm (6.25 in) D x 7.5 cm (3 in) H
Weight . . . . 0.55 Kg (1.2 lb)
Operating Temperature . . . . -30°C to +65°C
Usage . . . . L1/L2 GPS, SBAS and L-Band

Geodetic Reference Station Antenna

Size . . . . 34.3 cm (13.5 in) D x 7.6 cm (3 in) H
Weight . . . . 1.31 Kg (2.88 lb)
Operating Temperature . . . . -40°C to + 70°C
Usage . . . . L1/L2 GPS and SBAS

Humidity/Case. . . . All antennae are 100% condensing, unit fully sealed. Dust-proof, waterproof, shock resistant

OPTIONS

- Upgrade DGPS receiver to OmniSTAR XP/HP (includes dual frequency antenna)
- Upgrade OmniSTAR XP/HP receiver to RTK rover
- Upgrade for DGPS Reference Station

PERFORMANCE SPECIFICATIONS

Measurements

- Trimble EVEREST multi-path mitigation technology
- DGPS: 12 Channel L1 plus 2 channels for Beacon
- DGPS with SBAS (WAAS / EGNOS / MSAS): 11 GPS channels plus 1 for SBAS
- RTK or OmniSTAR VBS/XP/HP: 24 channel L1/L2 plus 1 channel L Band

Code differential GPS positioning

Horizontal accuracy . . . . ±(0.25m + 1 ppm) RMS ±(0.8 ft + 1 ppm)
Vertical accuracy. . . . . ±(0.50m + 1 ppm) RMS ±(1.6 ft + 1 ppm)

WAAS / EGNOS / MSAS[1]

Horizontal accuracy . . . . Typically 1m (3 ft)
Vertical accuracy. . . . . Typically <5m (<16 ft)

OmniSTAR Positioning

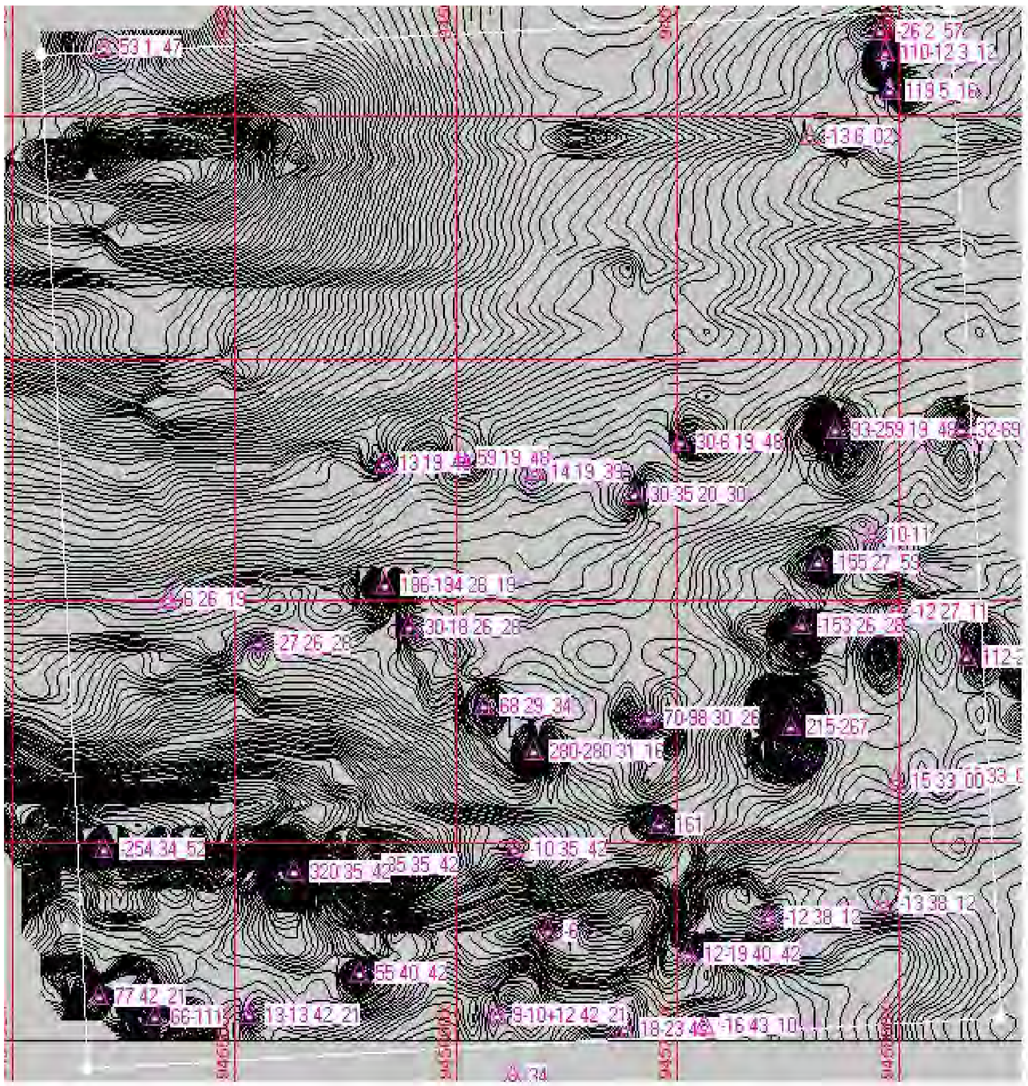
VBS Service Accuracy . . . . Horizontal typically better than 1 m (3 ft)
XP Service Accuracy . . . . Horizontal 10cm (.3 ft), Vertical 20cm (.7 ft)
HP Service Accuracy . . . . Horizontal 5cm (.2 ft), Vertical 10cm (.3 ft)
OmniSTAR XP/HP Convergence . . . Cold start - Typically 10 to 40 minutes

Appendix C – List of Attached Computer Files

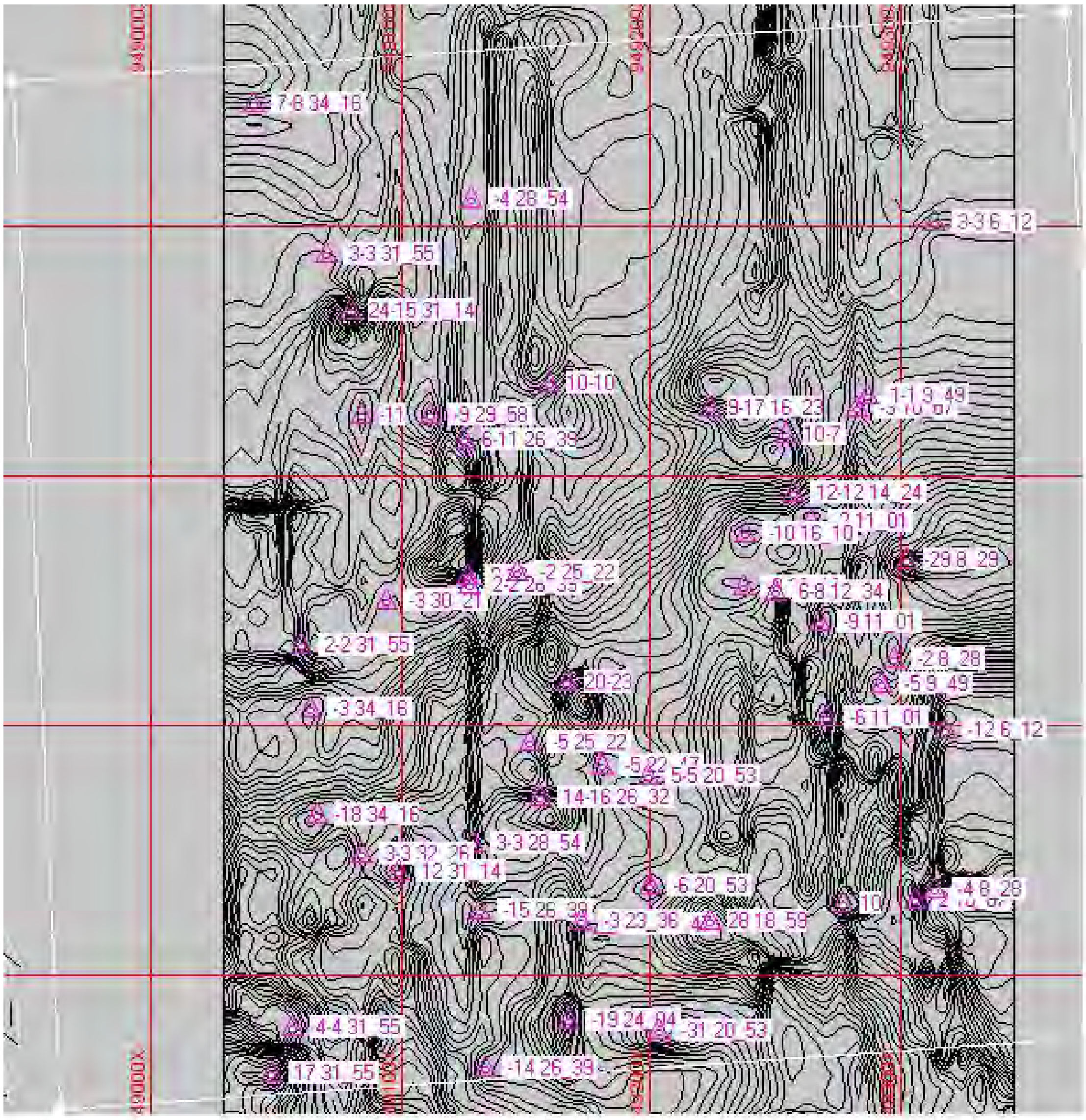
UW-1EW.tif	**Geo-Tiff of UW-1 east-west lines**
UW-1EW.tfw	**World file to accompany Geo-Tiff**
UW-1NS.tif	**Geo-Tiff of UW-1 north-south lines**
UW-1NS.tfw	**World file to accompany Geo-Tiff**
UW-2NS.tif	**Geo-Tiff of UW-2 north-south lines**
UW-2NS.tfw	**World file to accompany Geo-Tiff**

Appendix D – Contour Maps with Plotted Targets

UW-1 Contour Map with Plotted Targets

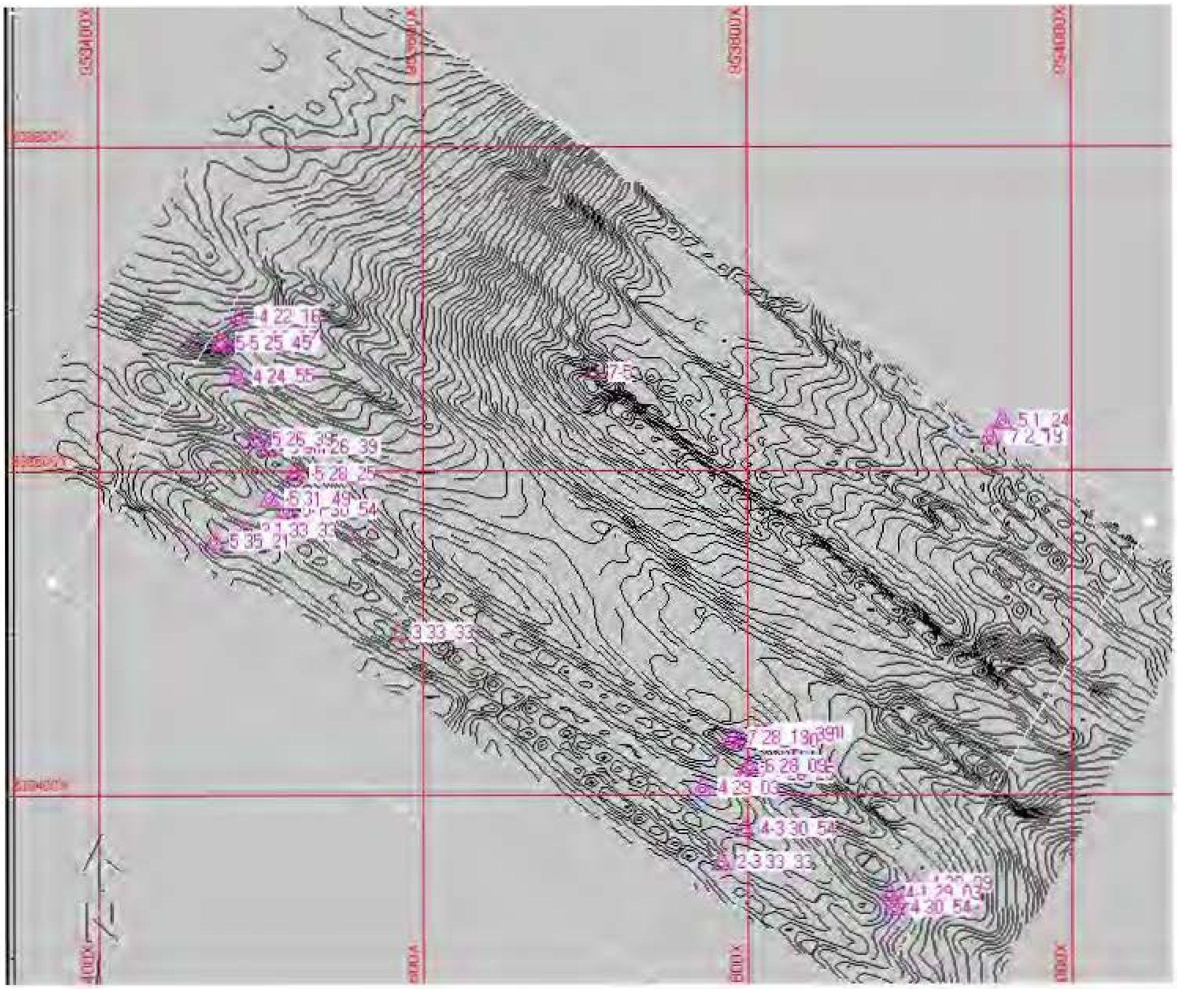


UW-2 Contour Map with Plotted Targets



UW-3 Contour Map with Plotted Targets

UW-4 Contour Map with Plotted Targets



Appendix E – Target Tables

UW-1 Target Table

#	nt line_time	Easting	Northing
1	-6	945642	810363
2	66-111	945464	810328
3	18-23 43_10	945676	810323
4	-16 43_10	945712	810324
5	9-10+12 42_21	945619	810328
6	13-13 42_21	945506	810328
7	77 42_21	945439	810336
8	12-19 40_42	945705	810354
9	34	945626	810303
10	55 40_42	945556	810346
11	-13 38_12	945793	810375
12	-12 38_12	945741	810369
13	11-Oct	945788	810526
14	30-35 20_30	945681	810544
15	14 19_39	945636	810553
16	161	945692	810407
17	13 19_48	945567	810557
18	59 19_48	945602	810559
19	30-6 19_48	945702	810565
20	93-259 19_48	945772	810570
21	-254 34_52	945441	810397
22	32-69	945828	810570
23	28 33_00	945822	810427
24	15 33_00	945799	810425
25	280-280 31_16	945635	810437
26	215-267	945751	810447
27	70-98 30_26	945687	810451
28	68 29_34	945612	810456
29	-85 35_42	945559	810390
30	-10 35_42	945627	810397
31	320 35_42	945526	810388
32	112-21 28_49	945830	810476
33	-155 27_59	945763	810515
34	-13 6_02	945760	810691
35	-12 27_11	945799	810495
36	186-194 26_19	945568	810505
37	6 26_19	945470	810500
38	-153 26_28	945756	810489
39	30-18 26_28	945578	810488
40	-27 26_28	945511	810481
41	53 1_47	945441	810728
42	-26 2_57	945791	810735
43	110-12 3_12	945794	810726
44	119 5_16	945796	810710

UW-2 Target Table

Pineros & Cabeza de Perro Islands

#	nt line_time	Easting	Northing
1	-4 28_54	949128	810210
2	9-12 28_54	949126	810059
3	3-3 28_54	949129	809952
4	-9 29_58	949111	810124
5	-2 11_01	949264	810082
6	-9 11_01	949268	810040
7	-6 11_01	949271	810003
8	-19 24_04	949167	809882
9	-3 10_07	949283	810127
10	2 10_07	949306	809930
11	-10 16_10	949238	810077
12	-8 16_10	949238	810055
13	7-8 34_16	949041	810248
14	-3 34_16	949064	810006
15	-3 30_21	949094	810049
16	3-3 32_26	949084	809948
17	-2 8_28	949297	810026
18	-4 8_28	949314	809934
19	14-16 26_32	949155	809971
20	6-8 12_34	949250	810053
21	2-2 26_39	949127	810056
22	-15 26_39	949131	809926
23	-14 26_39	949133	809863
24	-5 22_47	949181	809983
25	3-3 22_47	949181	809920
26	1-1 9_49	949287	810132
27	-5 9_49	949292	810016
28	5-5 20_53	949199	809979
29	-6 20_53	949200	809936
30	-31 20_53	949203	809877
31	3-3 31_55	949070	810188
32	2-2 31_55	949060	810031
33	4-4 31_55	949056	809879
34	17 31_55	949048	809860
35	3-3 6_12	949314	810201
36	-12 6_12	949318	809997
37	12 31_14	949099	809941
38	-2 25_22	949147	810060
39	-5 25_22	949151	809993
40	12-12 14_24	949257	810093
41	-3 23_36	949172	809921
42	24-15 31_14	949080	810166
43	-11	949084	810124
44	28 18_59	949224	809921
45	10	949277	809928
46	6-11 26_39	949125	810114
47	9-17 16_23	949224	810127
48	7-Oct	949254	810116
49	9-17 16_23	949224	810127
50	10-Oct	949159	810137
51	20-23	949166	810017

UW-2 Target Table

Pineros & Cabeza de Perro Islands

#	nt line_time	Easting	Northing
52	-18 34_16	949067	809964
53	-29 8_29	949302	810065

UW-3 Target Table

Pineros & Cabeza de Perro Islands

#	nt line_time	Easting	Northing
1	70 37_10	950686.7	806976.6
2	-25 36_41	950671.3	806989.3
3	26-? 35_47	950569	807010.3
4	41-35 35_47	950718.6	806989.6
5	-75 34_55	950540.3	807017.6
6	135-135 34_55	950805.7	806994.4
7	-252 33_03	950811.3	807008.4
8	320 33_03	950795.9	807001
9	38-36 33_23	950503.2	807035.7
10	44 33_23	950595.6	807034.3
11	179-147 33_23	950840.8	807003
12	?-235 32_30	950887.2	806994
13	-80 31_36	950510.4	807059.7
14	-39 31_36	950539.2	807057
15	25 31_36	950648	807042.1
16	40 31_36 Mooring	950736.5	807034.6
17	?-127 30_47	950617.1	807070.1
18	dipole	950596	807044
19	-57 28_58	950735	807054
20	-41 25_16	950781.6	807089.8
21	?-153 24_22 mooring	950835.5	807085.5
22	39-42 23_27	950492.4	807130.5
23	?-53 23_27	950690.5	807117
24	76-? 22_30	950551.3	807157
25	-74 22_35	950796.6	807116.8
26	34 21_06	950552.5	807148.8
27	105-85 21_06	950741	807139
28	38 21_06	950869.7	807120.3
29	-82 20_12	950638.4	807150.7
30	-29 20_12	950680.1	807146.3
31	131 19_17	950605.3	807162
32	99-? 19_17	950690.9	807161.4
33	150-148 19_17	950811.6	807149
34	96-272 18_22	950660	807183
35	-84 17_28	950643.7	807192.6
36	47 17_28	950726.4	807178.3
37	72-? 17_28	950868.1	807165
38	-40 16_33	950506.6	807205.2
39	?-31 16_33	950648.1	807221.6
40	?-32 16_33	950676.4	807216.5
41	163-93 16_33	950782	807188
42	-39 15_43	950653.5	807201.8
43	66 15_43	950560.8	807197.9
44	60-87 13_49	950858.3	807200.9
45	-134 13_49	950745.1	807211.7
46	46 12_55	950560.2	807235.1
47	13-16 12_55	950836	807214.1
48	-59 11_08	950658.6	807235.1
49	65 11_08	950734.2	807233.5
50	15-18 10_13	950860.7	807232.6

UW-3 Target Table

Pineros & Cabeza de Perro Islands

#	nt line_time	Easting	Northing
51	23 9_18	950823.1	807247.1
52	19-66 8_23	950581.2	807269.4
53	-43 8_23	950830.4	807256.2
54	63-159 7_27	950553	807284
55	9-18 7_27	950616.2	807293.6
56	-82 7_27	950835.6	807274.2
57	889 7_33	950705.1	807299.9
58	156-? 7_33	950786	807290.1
59	?-49 6_45	950551.2	807290.1
60	97-82 6_45	950616.8	807305.6
61	62 6_45	950703.9	807325.7
62	136-319 6_45	950727	807323
63	-57 11_57	950839.5	807220.7
64	38 11_02	950573.6	807258.1
65	48 11_06	950516.3	807231.3
66	-32 11_06	950744.8	807240.1
67	-8 11_06	950793.2	807231.5
68	-33 11_06	950840.6	807222
69	103 4_12	950577.3	807302.4
70	31 4_12	950628.9	807313.9
71	63 4_12	950745.4	807315.5
72	50 3_19	950600.3	807176.8
73	19 3_19	950617.2	807173
74	46-118 3_19	950690.4	807158.2
75	97 3_19	950812.2	807141.9
76	64 18_23	950599	807175.6
77	28 27_32	950522.7	807089.9
78	88 27_32	950576.5	807085
79	-116 27_32	950700.1	807081.5
80	105-152 27_32	950792.8	807067.2
81	-54 27_32	950839.9	807061.3
82	292 27_32	950898.9	807053.9
83	50-68	950833	807039
84	159 26_10	950792.8	807078.1
85	97-94 24_22	950809.4	807091.5
86	dipole	950690	807117
87	dipole	950729	807097
88	dipole	950552	807035

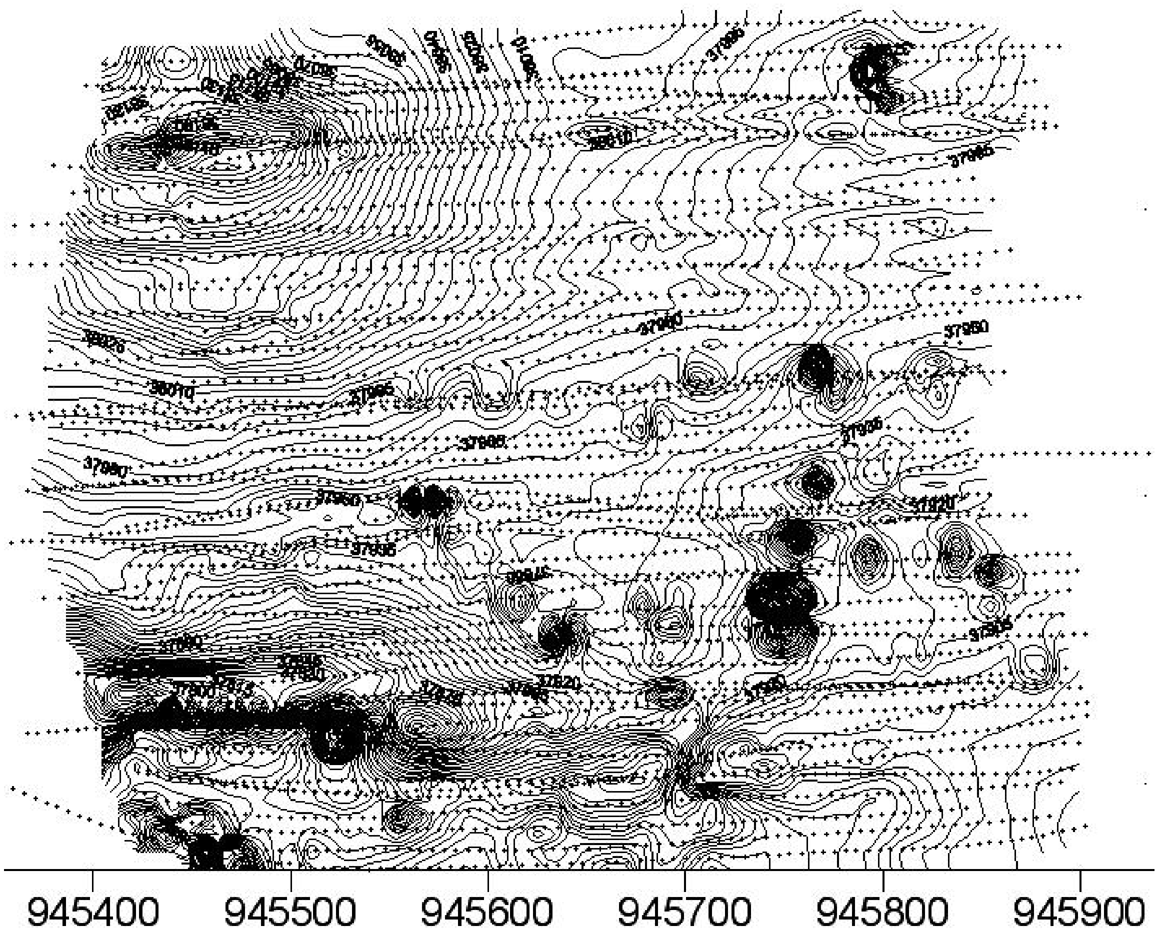
UW-4 Target Table

Pineros & Cabeza de Perro Island

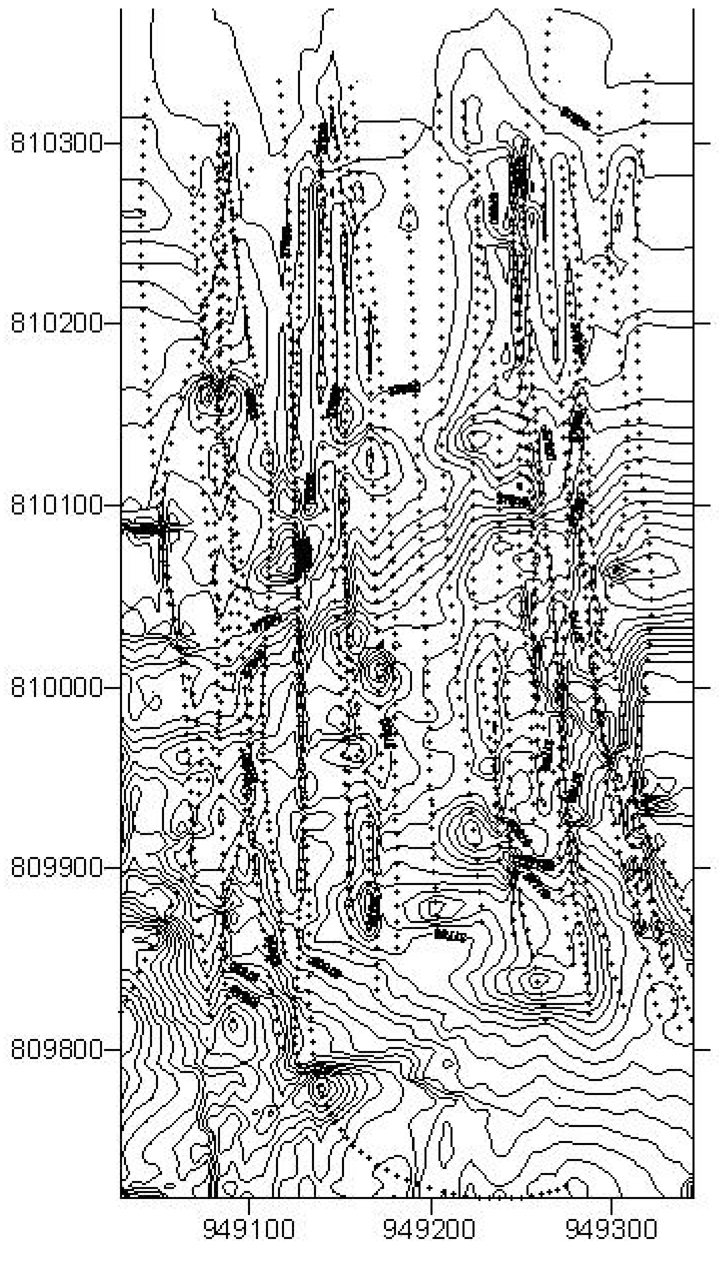
#	nt line_time	Easting	Northing
1	3-3 26_39	953504	808615
2	5 26_39	953806	808437
3	5-5 25_45	953474	808679
4	5 25_51	953811	808438
5	7 2_19	953949	808621
6	5 1_24	953957	808630
7	-4 22_16	953486	808695
8	2-2 23_12	953477	808680
9	4 23_07	953487	808682
10	4 24_55	953485	808658
11	5 25_51	953811	808438
12	5-5 25_45	953474	808679
13	5 26_39	953496	808620
14	5 26_39	953806	808437
15	6 26_30	953796	808433
16	-5 28_25	953520	808598
17	7-1 28_25	953797	808413
18	9 28_25	953897	808337
19	7 28_19	953791	808435
20	6 28_09	953801	808417
21	4 28_09	953903	808345
22	4 29_03	953772	808404
23	4-1 29_03	953887	808339
24	5-1 30_54	953515	808575
25	4-3 30_54	953798	808379
26	4 30_54	953890	808330
27	3-1 33_33	953490	808563
28	3 33_33	953584	808500
29	2-3 33_33	953784	808358
30	5 35_21	953470	808556
31	-5 31_49	953504	808583
32	7-5	953704	808660

Appendix F – Contour Charts with Line Tracks

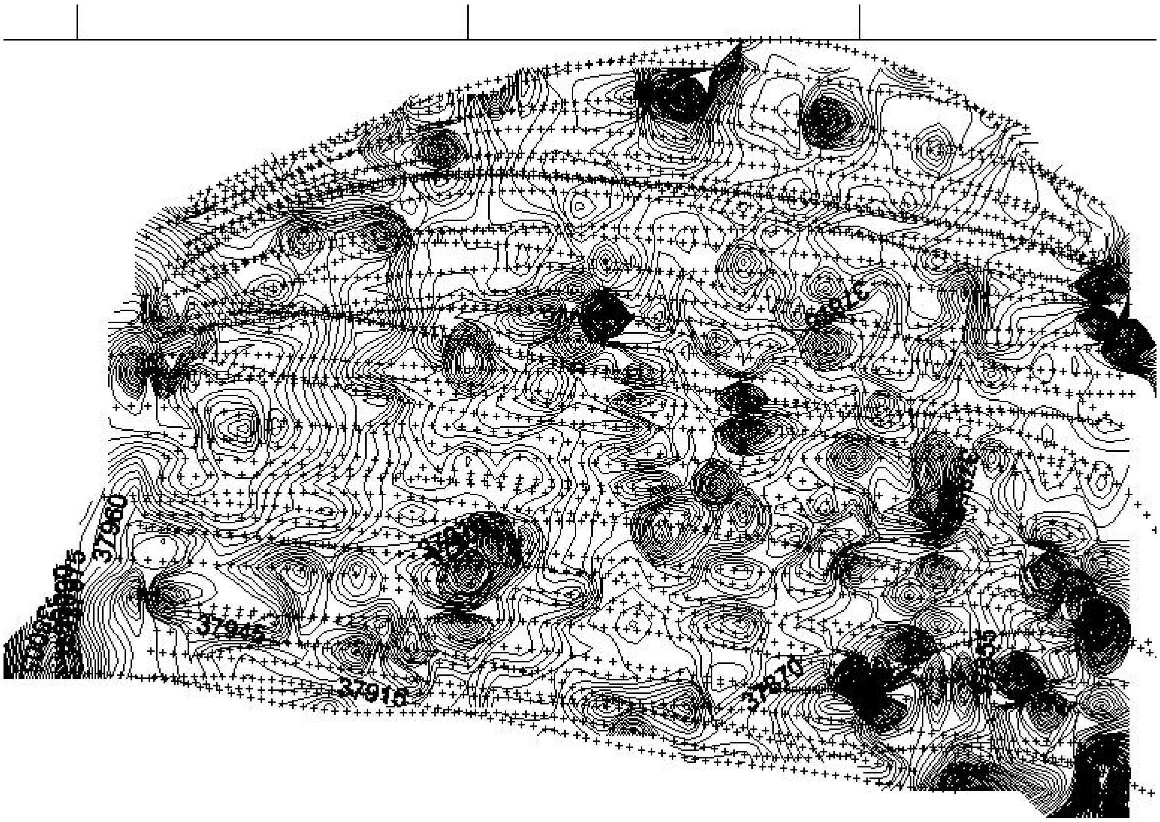
UW-1 Contour Map at 5nt/line with survey track lines overlay



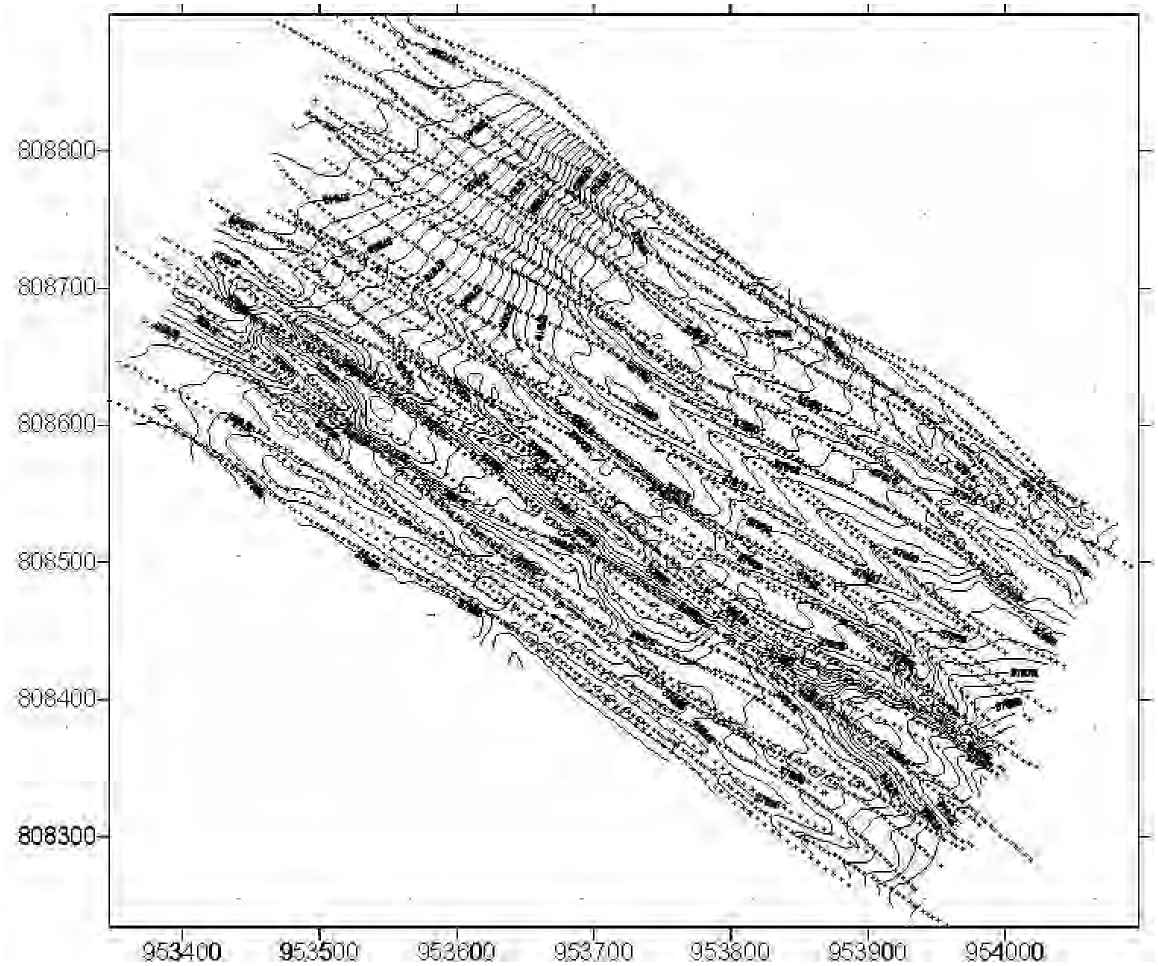
UW-2 Contour Map at 5nt/line with survey track lines overlay



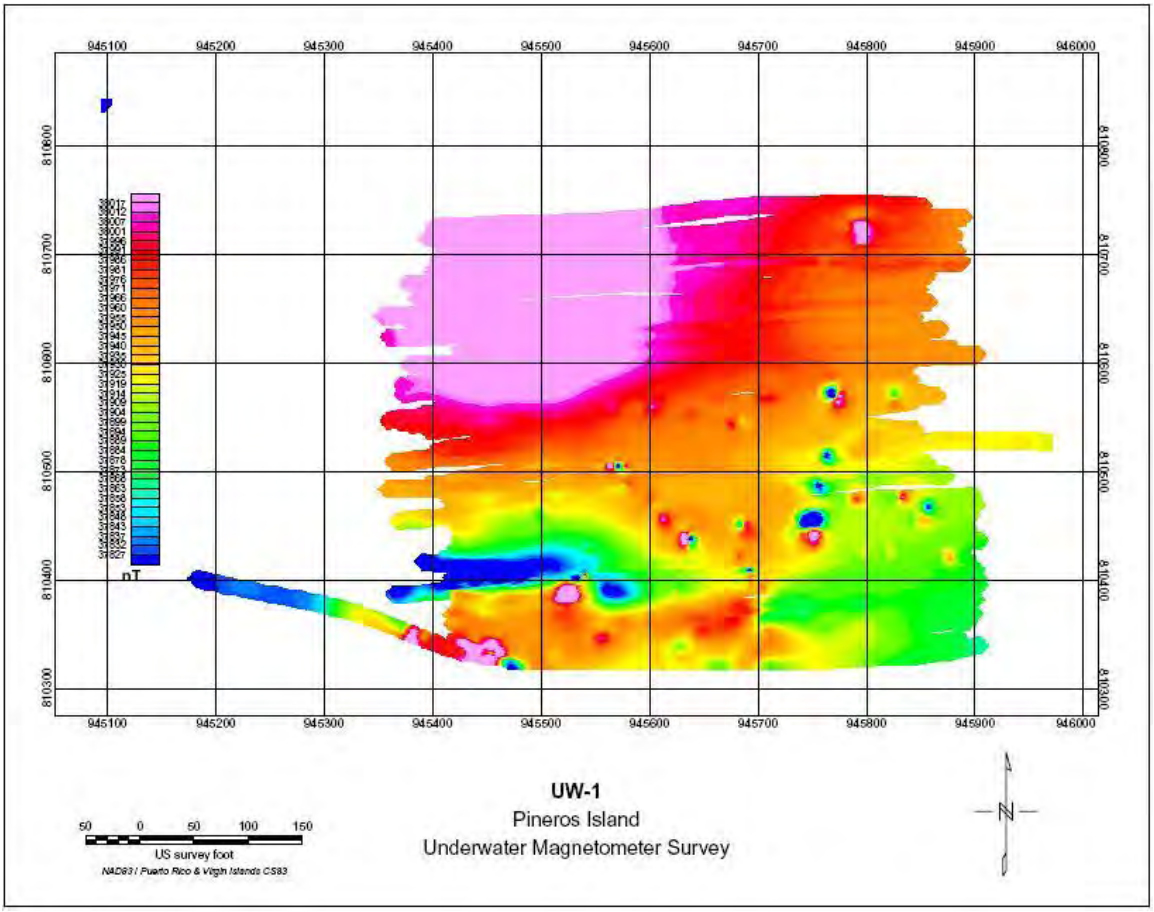
UW-3 Contour Map at 5nt/line with survey track lines overlay

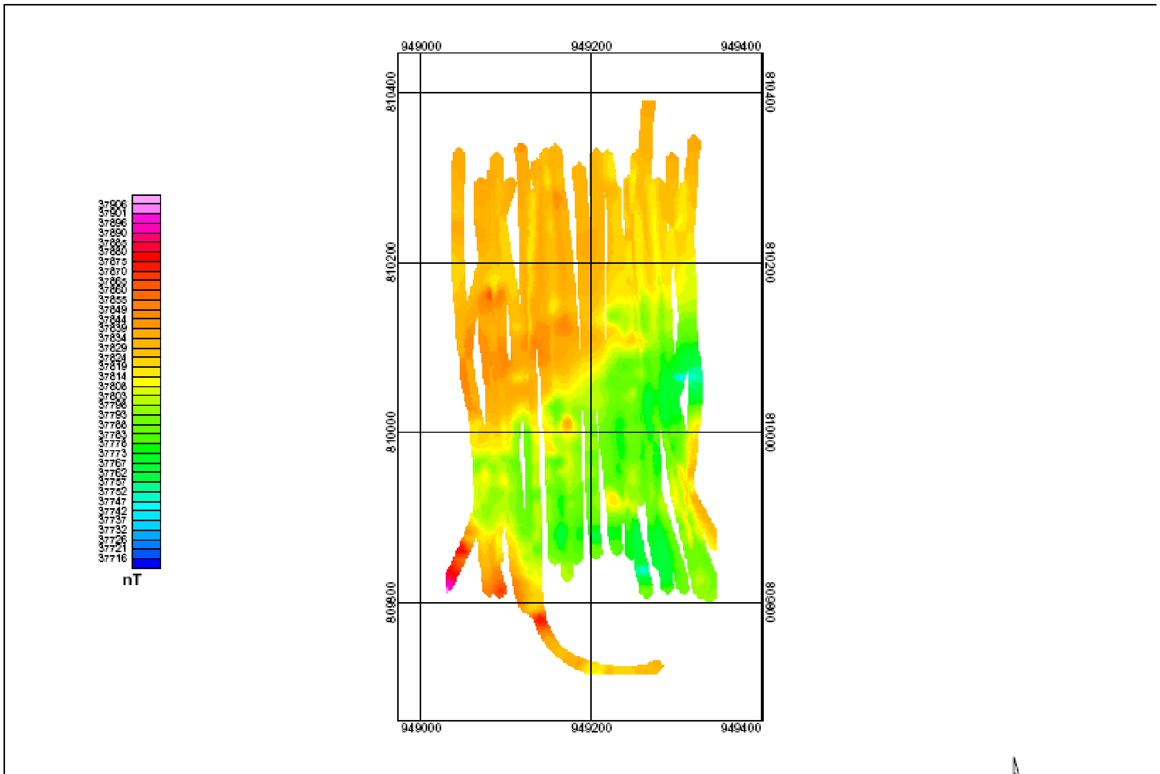


UW-4 Contour Map at 5nt/line with survey track lines overlay

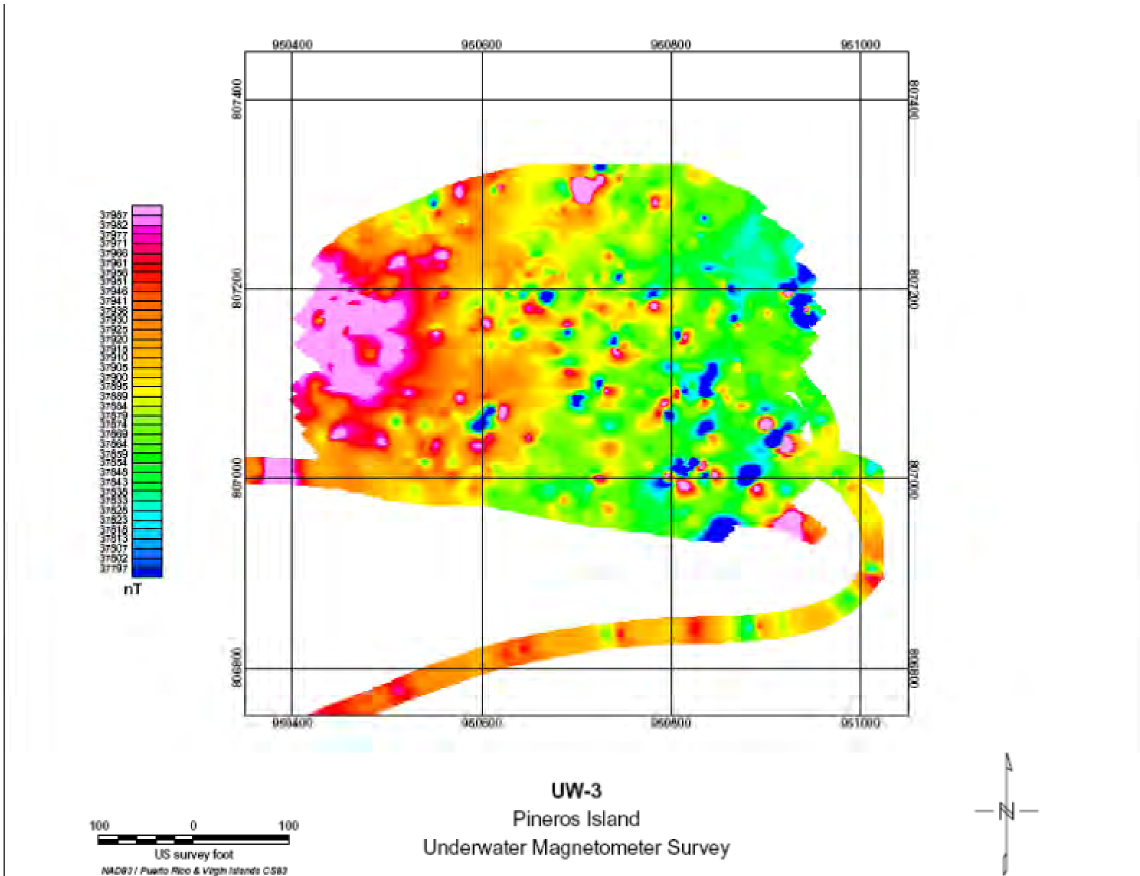


Appendix G – Color Charts

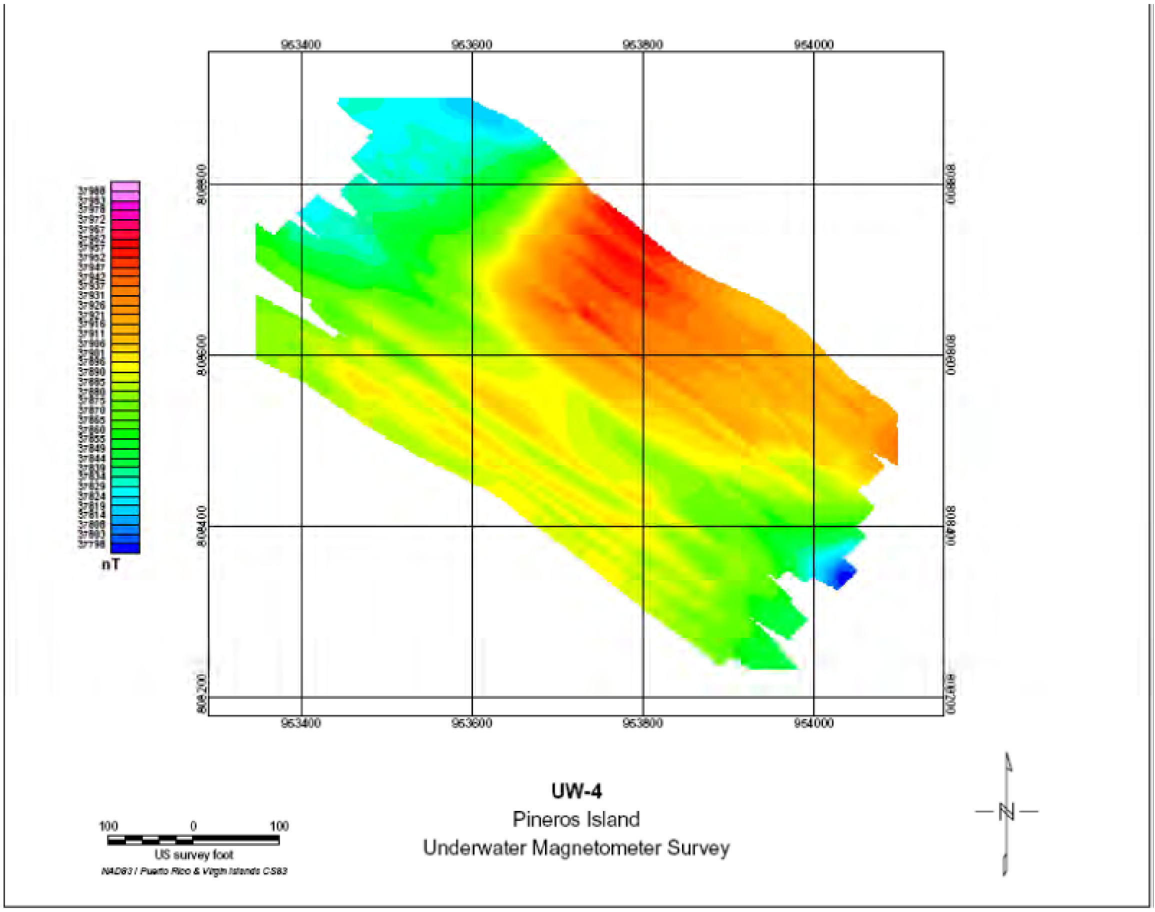




UW-2
Pineros Island
Underwater Magnetometer Survey



UW-3
Pineros Island
Underwater Magnetometer Survey


953400
953600
953800
954000
808600
808400
808200
nT
UW-4
Pineros Island
Underwater Magnetometer Survey
100
0
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US survey foot
NAD83 / Puerto Rico & Virgin Islands CS83
N

Appendix B
Health and Safety Plan

CH2M HILL Health and Safety Plan

This Health and Safety Plan (HASP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Phase I RFI Work Plan (CH2M HILL, 2006) and Work Plan Addendum No.2 (for Underwater Intrusive Investigation) (CH2M HILL, 2010). The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 400714/422049

CLIENT: NAVFAC, BRAC PMO SE

PROJECT/SITE NAME: CLEAN 1000 CTO-JM03/CTO-JM06 – Underwater Intrusive Investigation, Piñeros and Cabeza de Perro Islands, Puerto Rico

SITE ADDRESS: Naval Activity Puerto Rico

CH2M HILL PROJECT MANAGER: Tom Roth/ATL (INC)

CH2M HILL OFFICE: Atlanta

DATE HEALTH AND SAFETY PLAN PREPARED: 1/3/2011 (Modified 10/3/2011)

DATE(S) OF SITE WORK: October 2011

SITE ACCESS: Refer to attached Figure B-1. Underwater Sites UW-1, UW-2, and UW-3 are shown on Figure B-2. Access to all sites and Piñeros Island is physically unrestricted. Signs are posted along some shoreline access points on Piñeros Island warning visitors that the site is off-limits to non-military personnel.

SITE SIZE: Site UW-1 is approximately 8.1 acres in size, UW-2 is approximately 9.3 acres in size, and UW-3 is approximately 5.4 acres in size.

SITE TOPOGRAPHY: The underwater areas of investigation are located in eight to 25 feet of water in areas with gentle sloping seafloor.

The topography of Piñeros Island is characterized by a series of smooth, round hills and low-lying swampy areas. The hills range in elevation from less than 70 feet in the northwest to a hill of 250 feet above mean sea level (MSL) in the south-central portion of the island. Approximately two-thirds of the island is covered in dense jungle vegetation that makes inland access difficult without the use of machetes. Narrow beaches line parts of the island. The remainder of the island consists of lagoons and mangrove swamps.

PREVAILING WEATHER: The climate surrounding Piñeros Island is tropical marine, with minimal fluctuations in temperature, relatively moderate humidity, and frequent rain showers. The island is directly in the path of the easterly trade winds, which moderate temperature extremes.

The mean annual temperature at the former Roosevelt Roads Naval Station, located approximately 0.5 mile west of Piñeros Island, averages 79.9 degrees Fahrenheit (°F) based on data compiled from 1957 through 1982. Similar historical data show July and August as the warmest month, at 82.4°F, and February as the coldest month, at 76.8°F. The relative humidity averages 65 to 78%.

Rainfall on the island generally consists of brief showers throughout the year. The average annual rainfall on Piñeros Island is approximately 50 inches. The rainy season in this region is typically defined as May through November.

Winds in the vicinity of the former Roosevelt Roads Naval Station are typically from the east or northeast at an average speed of approximately 6 knots. Tropical storms and hurricanes are most likely to occur during the summer and early fall.

SITE DESCRIPTION AND HISTORY: Piñeros and Cabeza de Perro Islands are located in the Caribbean Sea, approximately one-half mile east of the former Roosevelt Roads Naval Station on the eastern coast of Puerto Rico, as shown on Figure B-3.

The Navy acquired Piñeros and Cabeza de Perro islands in the early 1940s as part of its general acquisition of land for the former Roosevelt Roads Naval Station. Shortly after the Navy acquired Piñeros and Cabeza de Perro islands, the British built a network of roads, gun emplacements, and bunkers on Piñeros Island for use during World War II. These facilities were abandoned after the war. Beginning in the late 1950s, Piñeros and Cabeza de Perro islands were utilized by Special Forces personnel for various training activities. Exercises included beach landings combined with sea-to-land gunfire and underwater demolition on offshore coral reefs, and small-arms training.

Training activities have taken place on all parts of Piñeros Island and in offshore waters around Piñeros and Cabeza de Perro islands. Prior to 1987, approximately 300 men, in groups of 50, were trained each year. Underwater demolitions teams utilized two beaches on the northern coast of Piñeros to practice detonating up to 500 pounds of underwater and land explosives. Training in setting up explosives without detonation also occurred at the south shore beach, which had an emplacement of 12 to 15 obstacles in the water jut off the beach. These suspected underwater demolition areas have been identified on historical charts as UW-1, UW-2, UW-3, and UW-4. Trails used for small-arms training led from the aforementioned beaches toward the center of the island. Units also utilized the large mangrove swamp on the southwest corner of the island to train for overland maneuvers and the location of objectives by compass at night.

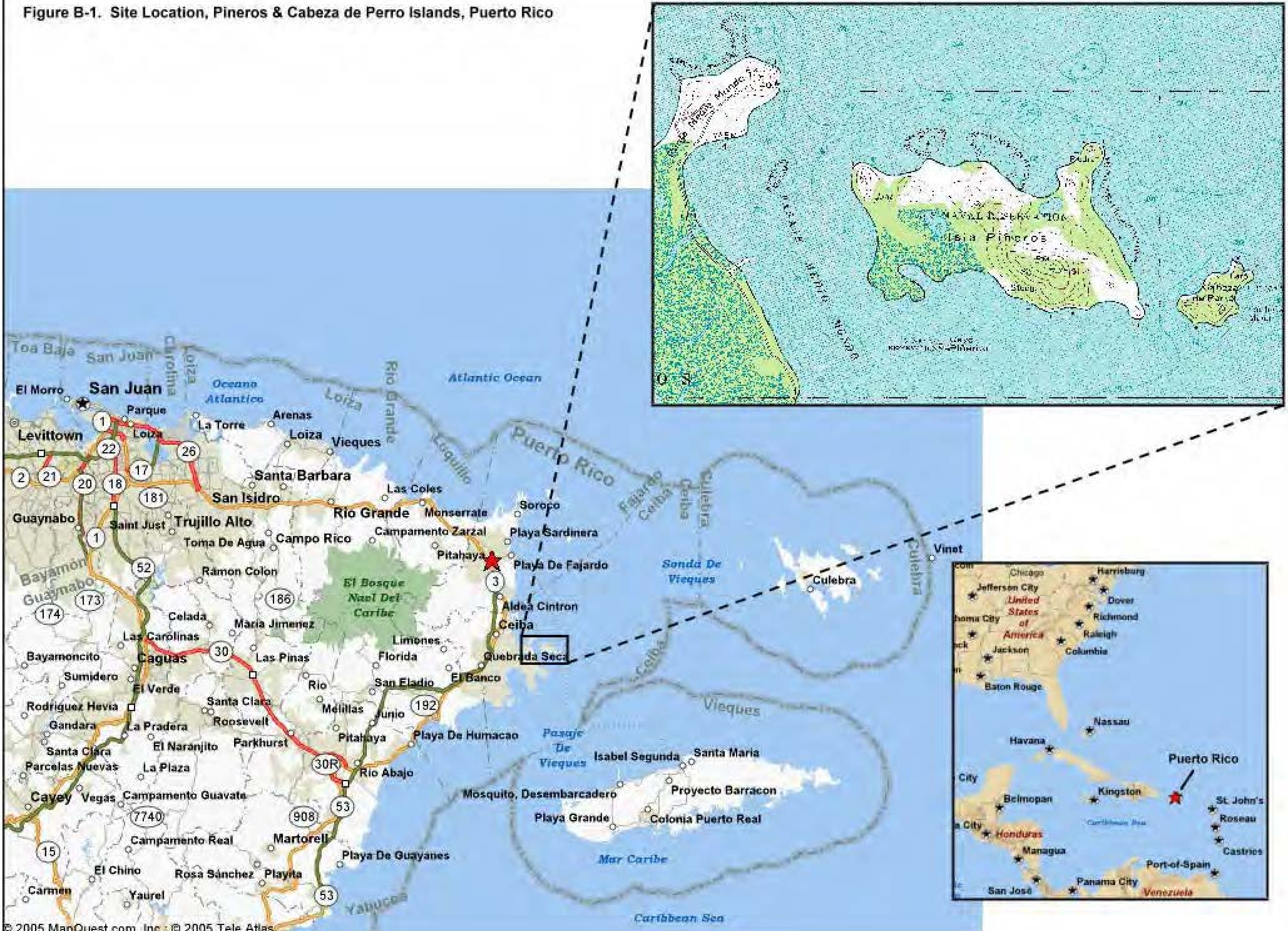
Other training activities at Piñeros and Cabeza de Perro islands have included survival techniques, land navigation, underwater and small-unit demolition, small boat operation, diving, small-arms training (5.56mm, 7.62mm, 9mm, .45 caliber [cal], .38 cal, and .50 cal) , pyrotechnics (smoke grenades, pop flares, grenade simulators, etc.) , and standard military demolitions (claymore mines, plastic explosives, etc.).

The former Naval Station Roosevelt Roads ceased operations in March 2004, and Naval Activity Puerto Rico (NAPR) was created to provide oversight during the final disposal of the property. Current NAPR operations are those necessary to maintain the property and provide utilities to personnel and agencies still present at NAPR. Because Piñeros and Cabeza de Perro islands were part of the former Naval Station Roosevelt Roads, military operations on those islands ceased with the closing of NAVSTA Roosevelt Roads, and the islands are now the responsibility of NAPR.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

- Layout of underwater transects using MEC avoidance procedures
- “Detect-and-dig” underwater intrusive investigation of anomalies encountered along transects
- Documentation of coral and sea grass in and adjacent to the underwater investigation areas to supplement the 2006 biological survey
- MEC/MPPEH that is safe to move will be transported to an adjacent beach or an inland area on Piñeros Island and demolished/demilitarized as necessary by controlled detonation
- MEC that is not safe to move will be left in place and the geographic coordinates will be recorded using a global positioning system (GPS)

Figure B-1. Site Location, Pineros & Cabeza de Perro Islands, Puerto Rico



VICINITY MAP

LEGEND

Planned Underwater Investigation Area

Suspected Former Underwater Demolition Area

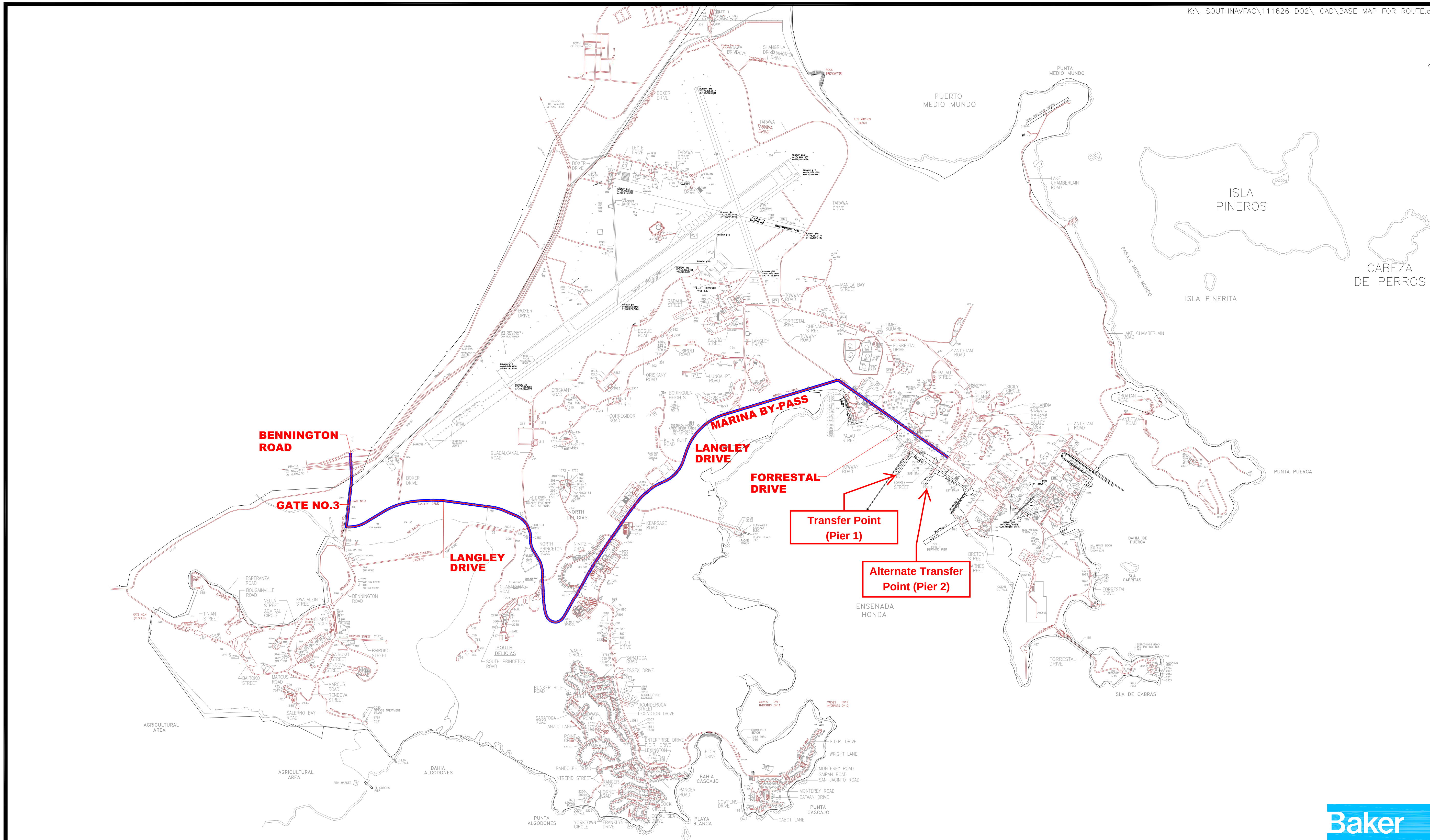
N

0 300 600

Feet

FIGURE B-2
Planned Underwater Investigation Areas

Phase I RCRA RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico



LEGEND

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

3000 0 1500 3000
1 inch = 3000 ft.

Figure B-3. Explosives Transportation Route and Transfer Point

NAVAL ACTIVITY PUERTO RICO

Contents

1 Employee Signoff Form – Field Safety Instructions
2 Project-Specific Chemical Product Hazard Communication Form
3 Chemical-Specific Training Form
4 Emergency Contacts
5 Project H&S Forms and Permits
6 Project Activity Self-Assessment Checklists
7 Applicable Material Safety Data Sheets

1 Tasks to be Performed

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Phase I RFI Work Plan [CH2M HILL, 2006] and Work Plan Addendum No.2 –Underwater Intrusive Investigation) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (HAZWOPER).

1.1.1 HAZWOPER-Regulated Tasks

General site workers, UXO-qualified personnel, general laborers, and supervisory personnel engaged in MEC removal actions (e.g., SUXOS, UXO Technician III) or other activities that expose or potentially expose them to health hazards, will meet the requirements of 29 CFR 1910.120 (e)(3)(i).

Other employees who perform work on the site, such as biological survey, shall meet the requirements of 29 CFR 1910.120(e)(iii).

Managers and supervisors shall be additionally certified as having received management and supervisory training that meets the requirements of 29 CFR 1910.120(e)(4).

Copies of certifications or certifications from the employer will be kept onsite.

1.1.2 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state HAZWOPER regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-HAZWOPER-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

1.2 Task Hazard Analysis

(Refer to Section 2 for hazard controls)

Potential Hazards	Tasks: Underwater MEC Intrusive Investigation	Tasks: Land-based demolition of MEC	Tasks: Surface Soil Sampling
Flying debris/objects	X	X	X
Noise > 85dBA	X	X	
Electrical			
Suspended loads			
Buried utilities, drums, tanks			
Slip, trip, fall	X	X	X
Back injury	X	X	X
Confined space entry			
Trenches / excavations	X	X	
Vehicle traffic			
Elevated work areas/falls			
Fires	X	X	
Poisonous plants and insects	X	X	X
Entanglement			
Heavy equipment			
Working near water	X	X	X
Working from boat	X		
Explosion Hazard	X	X	X

1.3 Activity Hazard Analysis for Munitions and Explosives of Concern

Principal Steps	Potential Hazards	Recommended Controls
Establishing underwater transects and boundaries	Accidental detonation of MEC	Personnel involved will attend site-specific health and safety training and daily safety briefings that will include procedures for MEC avoidance. UXO personnel will escort non-UXO personnel (if applicable) in areas that have not been marked as free of surface MPPEH. Mark and avoid MPPEH. Check location with magnetometer prior to driving stakes or placing underwater jackstay lines and anchors.
	Drowning	Personnel involved in water activities will be trained UXO-Qualified Divers; a dedicated Dive Supervisor will oversee all operations.

Principal Steps	Potential Hazards	Recommended Controls
	Wildlife, slips, trips, falls, insects, poisonous plants, use of hand tools.	Refer to the Activity Hazard Analysis section of this HASP.
MEC Intrusive Investigation	Accidental detonation of explosives	Personnel involved will attend site-specific health and safety training and daily safety briefings
		MEC and MPPEH is not to be handled by anyone who is not UXO-Qualified Personnel
		MEC that is unsafe to move will be sandbagged and left in place
	Drowning	Personnel involved in water activities will be trained UXO-Qualified Divers; a dedicated Dive Supervisor will oversee all operations.
	Wildlife, slips, trips, falls, insects, poisonous plants, use of hand tools.	Refer to the Activity Hazard Analysis section of this HASP.
Land-based Demolition of MEC	Accidental detonation of explosives	Personnel involved will attend site-specific health and safety training and daily safety briefings
		MEC and MPPEH is not to be handled by anyone who is not UXO-Qualified Personnel
	Wildlife, slips, trips, falls, insects, poisonous plants, use of hand tools.	Refer to the Activity Hazard Analysis section of this HASP.
Surface Soil Sampling (following demolition)	Exposure to Munitions Constituents	Sampling personnel will wear proper personal protective equipment.
	Wildlife, slips, trips, falls, insects, poisonous plants, use of hand tools.	Refer to the Activity Hazard Analysis section of this HASP.

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in **Attachment 6**. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

2.1 Behavior Based Loss Prevention System

(Reference *CH2M HILL SOP HSE-103, Behavior Based Loss Prevention System*)
A Behavior Based Loss Prevention System (BBLPS) is a system to prevent or reduce losses using behavior-based tools and proven management techniques to focus on behaviors or acts that could lead to losses.

The four basic Loss Prevention tools that will be used by CH2M HILL projects to implement the BBLPS include:

- AHA (discussed in Section 3.1)
- Pre-task Safety Plans (PTSP)
- Safe Behavior Observations (SBO)
- Loss and Near Loss Investigations (NLI) (discussed in **Section 9.7)**

The SSC, UXO Safety Officer (UXOSO), or designated CH2M HILL representative onsite is responsible for implementing the BBLPS on the project site. The Project Manager (PM) remains accountable for its implementation. The SSC, UXOSO, or designee shall only oversee the subcontractor's implementation of their AHAs and PTSPs processes on the project.

2.1.1 Pre-task Safety Plans

Daily safety meetings are held with all project personnel in attendance to review the hazards posed and required H&S procedures/AHAs, which apply for each day's project activities. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day's activities, the crew supervisor completes the PTSP, provided in **Attachment 5,** with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required H&S procedures, as identified in the AHA. The use of PTSPs better promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required H&S procedures with the crew each day. The use of PTSPs is a common safety practice in the construction industry.

2.1.2 Safe Behavior Observations

SBOs shall be conducted by SSC, UXOSO, or designee for specific work tasks or operations comparing the actual work process against established safe work procedures identified in the project-specific HASP and AHAs. SBOs are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss. At least one SBO will be performed each week for tasks/operations addressed in the HASP or AHA. The SBO form in **Attachment 5** will be completed for the task/operation being observed and submitted by the PM weekly to the CH2M HILL SBO Mailbox.

2.2 Project-Specific Hazards

2.2.1 Heat Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC to avoid progression of heat-related illness.

2.2.2 Sun Exposure

Health effects regarding UV radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer.

Acute overexposure of UV radiation to the eyes may lead to photokeratitis (inflammation of the cornea), also known as snow blindness. Symptoms include redness of the eyes and a gritty feeling, which progresses to pain and an inability to tolerate any kind of light. This condition can also occur when working in or around water and other UV radiation reflectors. In addition, longterm exposure to sunlight is thought to cause cataracts or clouding of the lens of the eye.

- Limit Exposure Time
  - Rotate staff so the same personnel are not exposed all of the time.
  - Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
  - Avoid exposure to the sun, or take extra precautions when the UV index rating is high.
- Provide Shade
  - Take lunch and breaks in shaded areas.
  - Create shade or shelter through the use of umbrellas, tents, and canopies.
  - Fabrics such as canvas, sailcloth, awning material and synthetic shade cloth create good UV radiation protection.
  - Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.
- Clothing
  - Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
  - Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or “Foreign Legion” style caps offer added protection.
  - Wear UV-protective sunglasses or safety glasses. These should fit closely to the face.
  - Wrap-around style glasses provide the best protection.
- Sunscreen
  - Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
  - Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
  - Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
  - Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.
  - Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.

Remember – no sunscreen provides 100% protection against UV radiation. Other precautions must be taken to avoid overexposure.

2.2.3 Working Near Water

When working near water, and there is a risk of drowning or falling in:

- U.S. Coast Guard-approved personal flotation devices (PFDs), or life jacket, provided for each employee will be worn.
- PFDs will be inspected before and after each use. Defective equipment will not be used.
- Sampling and other equipment will be used according to the manufacturer's instructions.
- A minimum of one life-saving skiff will be provided for emergency rescue.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope will be provided for emergency rescue.

2.2.4 Working on Water

- Safe means of boarding or leaving a boat or a platform will be provided to prevent slipping and falling.
- The boat/barge must be equipped with adequate railing.
- Employees should be instructed on safe use.
- Work requiring the use of a boat will not take place at night or during inclement weather.
- The boat/barge must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.).
- The engine should be shut off before refueling; do not smoke while refueling.
- Ensure at least one employee trained in CPR and first aid is on site during work activities.

2.3 General Hazards

2.3.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-209, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness requires enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.

- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.3.2 Hazard Communication

(Reference CH2M HILL SOP HS-05, *Hazard Communication)*

The SSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Provide employees with required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.3.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's Procedures for Shipping and Transporting Dangerous Goods)

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.3.4 Lifting

(Reference CH2M HILL SOP HS-112, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
  - Plan storage and staging to minimize lifting or carrying distances.

- Split heavy loads into smaller loads.
- Use mechanical lifting aids whenever possible.
- Have someone assist with the lift exceeding 40 lbs. -- especially for heavy or awkward loads.
- Make sure the path of travel is clear prior to the lift.

2.3.5 Fire Prevention

(Reference CH2M HILL SOP HS-208, *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post “Exit” signs over exiting doors, and post “Fire Extinguisher” signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.3.6 Electrical

(Reference CH2M HILL SOP HS-206, *Electrical*)

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - equipped with third-wire grounding.
  - covered, elevated, or protected from damage when passing through work areas.

  - protected from pinching if routed through doorways.
  - not fastened with staples, hung from nails, or suspended with wire.

- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.3.7 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.3.8 Procedures for Locating Buried Utilities

The project site is located in the waters surrounding an uninhabited island with no utilities; therefore, buried utility requirements do not apply.

2.3.9 Confined Space Entry

(Reference CH2M HILL SOP HS-203, *Confined Space Entry*)

No confined space entry will be permitted. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, contact the HSM to develop the required entry permit.

When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel are to be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and hazards.

2.3.10 Knife Use

Knives (fixed/utility) shall not be used. If it is demonstrated that a knife is the right tool for the job, this plan will be amended and the activity that knife use will be used for shall be reviewed. An AHA shall also be developed to address hazards and subsequent controls, personal protective equipment (PPE), and training.

Responsibilities	Supervisors with assistance from the SSC or Senior Unexploded Ordnance Supervisor (SUXOS) are responsible for funding and ensuring the correct tool is being used, employees wear the proper PPE when using knives, and they have reviewed this policy. Employees are responsible for having and utilizing the proper PPE while performing an activity requiring the use of a knife. Employees are also responsible for understanding the proper use of a knife.
Glove Requirements	In general, Kevlar® cut-resistant gloves are to be worn when using a knife in an occupational setting. Other types of gloves may be required and will be identified within the AHA/written procedure. Example - Leather gloves may be worn when using the acetate sleeve cutter.
Training (Refer to the CH2M HILL Virtual Office for additional hand safety topics)	All employees that will use a knife must be trained in the proper use. When using a knife always cut away from yourself. Many tasks using a utility knife require a knife edge but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade. If you use a folding knife, it must be a locking blade type. Never use a knife that will fold under pressure. If you use a fixed-blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also make sure the handle is dry and not greasy or slippery to assure a better grip. When cutting, make the force of the cut carry the blade away from any part of your body. If you have a peculiar situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise or other holding device. If you carry a fixed-blade knife, use a sheath or holder. Store utility knives safely, retract the blade or sheath an open blade before storing. Never leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet. Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of slip or mistake. Knives used on the job, but not carried with you , must be properly stored when not in use Never use a defective knife. Utility knife blades are brittle and can snap easily. Do not bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a pry bar, screw driver, or hole punch. If you do get cut, seek medical attention to treat the injury by notifying your supervisor and contacting Health Resources at 1-866-893-2514.

Stay focused on the cutting job. It only takes a second of inattention with a sharp blade to produce a serious cut. Letting the mind wander or talking with others while using a knife greatly increases the risk of an accident and injury. If you are interrupted while working with a knife, stop cutting, retract the blade, and place the knife down on a secure surface before dealing with the interruption. You should never continue cutting while distracted!

As always, utilize the hierarchy of controls and first attempt to engineer out the hazard and frequently ask ourselves do we have the right tool for the job.

2.4 Biological Hazards and Controls

2.4.1 Snakes

No poisonous snakes are indigenous to Puerto Rico.

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.4.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac are not present in tropical locations, including Piñeros and Cabeza de Perro Islands.

2.4.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.4.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. Keep bees away by wearing light-colored clothing; avoiding scented soaps and perfumes; and containerizing all food, drinks, and garbage containers.

If stung, and a stinger is present, it should be removed by scraping the stinger away in a side-to-side motion with a fingernail, stiff paper, or credit card. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops. Ice or a cold compress and pain-relieving creams or oral medications may used if needed.

2.4.5 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.4.6 Mosquito Bites

West Nile Virus activity has been detected in Puerto Rico; therefore, it is recommended that **preventative measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N, N-diethyl-meta-toluamide). DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3-15 days.

If you have any questions or to report any suspicious symptoms, contact the project Health and Safety Manager.

2.4.7 Fire Ant Bites

Fire ants are present in Puerto Rico, although their presence on Piñeros and Cabeza de Perro Islands is unknown. These insects typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. However, it is possible that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention.

2.4.8 Other Anticipated Biological Hazards

The following paragraphs identify the potential hazards associated with flora and fauna at the site. If additional concerns are identified, they will be added to this Site Safety Health Plan.

Hazardous Flora. Incidence of contact by individuals to poisonous and thorny plants is high; therefore, bare skin should be covered (i.e., long pants and shirt, steel-toed boots, leather or cotton gloves, safety glasses, and head protection) as much as practical when working in forested or densely vegetated areas. Personnel should avoid entering an area in the direct path of known poisonous flora; a secondary route should be selected. Care should also be taken when walking in such areas because uneven terrain or vines may present a tripping hazard.

While attempting to cut into dense underbrush, hazards exist from the sharp machete and gas-powered weed cutter. Therefore, care should be taken when using such devices. (Note: Hearing protection, steel-toed boots, gloves, and safety glasses are required when using weed cutters.) All rashes and other injuries will be reported to the UXOSO as soon as they are known.

Five plants potentially present on Piñeros Island that are known to be irritating/allergens are Christmas-bush (*Comocladia dodonaea*), White maran (*Croton discolor*), Cowitch (*Stizolobium pruriens*), Manchineel (*Hippomae mancinella*), and Castor bean (*Ricinus communis*):

- Christmas-bush - *Comocladia dodonaea* - is a fairly small shrub that has waxy looking leaves that have a small spine at the end of each of them. The leaves can vary in color from green to yellow to red. The sap and residue on the leaves contain a chemical similar to those found in poison ivy but in a higher concentration.
- White maran - *Croton discolor* - is a fairly large bush (up to 7 ft. tall) that looks like it is drying out and doesn't have long to live. There are two species on the island, but both look very similar and have very hairy leafs. The leaves have a tendency to stick to your clothing because of the hairs of the leaves.
- Cowitch - *Stizolobium pruriens* - is commonly known as Pica-Pica as well as Cowitch. It is a vine that, if cut or disturbed, will release hairs that can cause skin irritations.
- Manchineel - *Hippomae mancinella* - is an evergreen tree found in coastal forest or thickets and can be more toxic than poison ivy or poison sumac. Its sap produces lesions similar to chemical burns.
- Castor bean - *Ricinus communis* - has sap that can cause skin lesions and is found in previously disturbed coastal areas.

Hazardous Fauna. Mosquitoes and sand flies may pose a nuisance and physical hazard to field personnel; they distract workers, leading to accidents, and pose a physical threat by transmitting live microorganisms. Sand fly bites that are repeatedly scratched can cause secondary infections. Avoid the use of perfumes and scented deodorants, and don light-colored clothing. The use of Avon's "Skin So Soft" or other insect repellent is encouraged.

The potential exists to come in contact with other dangerous insects; these include centipedes, fire ants, bees, wasps, hornets, mites, fleas, and spiders. All personnel should perform "checks" on each other periodically and at the end of the work shift, especially when working in grassy or forested areas. All insect bites must be reported to the UXOSO.

Mongooses, rats, and mice have been documented to potentially carry rabies. There is some evidence that mongooses can be infected with the rabies virus in an attenuated form, allowing them to carry and spread the virus for a considerable time before succumbing to the disease. Any observed unusual behavior by mongooses and other mammals must be reported. Signs of rabies can be characterized in two forms. Animals with furious rabies exhibit agitation and viciousness, followed by paralysis and death. Animals with dumb rabies exhibit lethargy and paralytic symptoms, followed by death. Behavioral indicators for both include fearlessness and change in nocturnal/diurnal rhythms.

Working in wet or swampy areas unprotected shall not be allowed because of the presence of a variety of etiologic (disease-causing agents). Contact with surface water will be kept to a minimum. There have been several incidents of infection by schistosomes (blood flukes) from contact with surface water. The aquatic snail vector, *Australorbis glabratus*, transmits the schistosomes into surface waters, predominantly drainage ditches. Even momentary contact (especially in the presence of blisters, cuts, and open sores) with contaminated surface water is sufficient to acquire an infection. Accidental skin contact requires that the area be washed with isopropyl alcohol. Symptoms of infection are fever, diarrhea, itchy skin, and central nervous system (CNS) damage. Schistosomiasis is hard to treat; once established in its host, it may remain for several years.

Before beginning site activities, each individual shall be questioned as to any known sensitivities to the previously mentioned organisms or agents.

Dengue Fever and other Illnesses. According to the Centers for Disease Control (CDC), Dengue Fever is primarily a viral infection transmitted by mosquito bites in residential areas. The mosquitoes are most active during the day, especially around dawn and dusk, and are frequently found in and around human habitations. The illness is flu-like and characterized by sudden onset, high fever, severe headaches, joint and muscle pain, and rash. The rash appears 3 to 4 days after the onset of fever. Because there is no vaccine or specific treatment, prevention is important. To reduce mosquito bites, travelers should wear clothes that cover most of the body. Travelers should also take insect repellent with them to use on any exposed areas of skin. The most effective repellent is DEET (N, N-diethyl meta-toluamide). Avoid applying high-concentration DEET (greater than 35 percent) products to the skin and refrain from applying repellent to portions of the hands that are likely to come in contact with the eyes and mouth. Rarely, toxic reactions or other problems have developed after contact with DEET. For greater protection, clothing can be soaked in or sprayed with permethrin, which is an insect repellent licensed for use on clothing. If applied according to directions, permethrin will repel insects from clothing for several weeks.

Traveler's Diarrhea is the most frequent health problem for travelers. It can be caused by viruses, bacteria, or parasites that are found universally throughout the region. Transmission is most often through contaminated food or water. Purchase food and beverages from vendors that are professional. Avoid small roadside stands and drink bottled beverages when possible. The use of over-the-counter or prescriptions medications can reduce the length of the attack.

Hepatitis A is a viral infection of the liver transmitted by the fecal oral route; through direct person to person contact; from contaminated water, ice, or shellfish; or from fruits or uncooked vegetables contaminated through handling. Symptoms include fatigue, fever, loss of appetite, nausea, dark urine, jaundice, vomiting, aches and pains, and light stools. No specific therapy supportive care is available, only supportive care. The virus is inactivated by boiling or cooking to 85ºC for 1 minute. Therefore, eating thoroughly cooked foods and drinking only treated water serve as general precautions. CDC recommends hepatitis A vaccine as a precaution.

2.5 Radiological Hazards and Controls

Refer to CH2M HILL's *Corporate Health and Safety Program, Program and Training Manual,* and *Corporate Health and Safety Program, Radiation Protection Program Manual*, for standards of practice in contaminated areas.

Hazards	Controls
None Known	None Required

2.6 Munitions and Explosives of Concern Hazards and Controls

2.6.1 Munitions and Explosives of Concern

Geophysical anomalies have been identified in the underwater areas UW-1, UW-2, and UW-3 surrounding Piñeros Island. The purpose of the underwater intrusive investigation at Piñeros Island is to determine whether any of the geophysical anomalies discovered during DGM are MEC or MPPEH items. Safe–to-move MEC, MPPEH, and other debris items will be hand-carried or floated on a water craft to a terrestrial processing location on Piñeros Island. MEC, MPPEH, and other debris will be segregated before transport and will remain segregated during transport. All safe-to-move MPPEH will be placed in a temporary MPPEH collection point located on Piñeros Island prior to disposal via detonation. All work will follow the approved Work Plan Addendum and Explosives Safety Submission (ESS).

MEC that is not safe to move will be left in place and the location will be recorded using a GPS.

2.6.2 MEC Avoidance Procedures

MEC avoidance operations will be required while establishing transects and conducting sampling operations. Avoidance operations will consist of a team composed of two UXO Technicians, one of which shall be a UXO Technician II.

2.6.3 MEC Procedures

All field activities will be conducted in accordance with the approved Work Plan Addendum and ESS. In addition to the Work Plan Addendum a copy of the approved ESS will be onsite during all field activities. All personnel are required to follow these instructions at all times. When a conflict between these documents and working conditions exists, the ESS will take precedence.

2.6.4 Munition with the Greatest Fragmentation Distance

Based on the types of munitions used at Piñeros and Cabeza de Perro Islands, the munition with the greatest fragmentation distance (MGFD) is the 66mm M72A2 (LAW) Rocket.

2.6.5 Hazard Mitigation

The Explosives Safety Quantity-Distance (ESQD) information for the MGFD is provided in Section 6 of the Work Plan Addendum. In the unlikely case a MEC item with a greater fragmentation distance than the contingency MGFD is encountered, the ESQD arcs will be adjusted and the ESS will be amended.

2.6.6 Types of Explosives to be used Onsite

No explosives will be stored on-site. Explosives for demolition operations will be provided by a licensed vendor on an on-call basis. The explosives vendor will transport explosive material to the NAPR installation and will transfer them in a “day box” portable magazine to a private charter boat, which will transport the explosives to Piñeros Island. Custody of the portable magazine will remain the responsibility of the explosives vendor, whose representative will accompany the portable magazine on the boat under the supervision of the UXO Subcontractor’s UXOSO. The explosives vendor’s transportation route and the transfer point are shown on Figure B-3. The explosives vendor will enter the NAPR installation at Gate No. 3 on Bennington Drive, where he will be met by the UXO Subcontractor’s UXOSO and a NAPR representative. After confirming the vendor’s credentials and manifest, he will proceed along the following route: south on Bennington Road; turn left and proceed east on Langley Drive; continue to proceed east on Marina By-pass; turn right and proceed southeast on Forrestal Drive; turn right and proceed southwest on the roadway to Pier 1 or Pier 2.

2.6.7 Explosives Storage, Transportation, and Management

Explosives will not be stored onsite. Transportation and management will be in compliance with the Explosives Management Plan (EMP) and the Explosives Siting Plan (ESP) for this project. The ESP and EMP are provided in Section 5 and Section 6 of the Work Plan Addendum, respectively.

Chemical hazards associated with MEC include toxicity. Toxicity may occur following inhalation of chemical vapors that could potentially be released from soil and ingestion or direct contact with soil and/or ground water that could potentially contain hazardous substances. Therefore, ensure basic sanitation (washing of hands), eating, smoking, etc., are prohibited in the demolition area.

Explosive residues such as 2,4,6-trinitrotoluene (TNT) 1,3-dinitrobenzene (DNB) and 1,3,5-trinitrobenzene (TNB) are synthetic substances used in explosives. They dissolve in certain liquids. They have no odor or taste, but could affect the nervous system and liver if swallowed or gets on the skin. Exposure to residues can occur through eating, drinking, touching, or inhaling contaminated soil, water, food or air. Therefore ensure proper PPE use, and basic sanitation (washing of hands); eating and smoking are prohibited in the demolition area.

2.7 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
2,4,6-trinitrotoluene (TNT) and	GW: NA SB: NA SS: Unknown	1.5 mg/m^3	500 mg/m^3	Irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough, sore throat; peripheral neuropathy, muscle pain; kidney damage; cataract; sensitization dermatitis; leukocytosis (increased blood leukocytes); anemia; cardiac irregularities	UK
1,3-dinitrobenzene (DNB)	GW: NA SB: NA SS: Unknown	1 mg/m^3	50 mg/m^3	Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage	UK

Footnotes:
[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).
[b] Appropriate value of PEL, REL, or TLV listed.
[c] IDLH = immediately dangerous to life and health (units are the same as specified “Exposure Limit” units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.
[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.8 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-113, *Medical Surveillance*, and HS-02, *Health and Safety Training*)

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Client Contact	Facility Contact
Mark Davidson	Pedro Ruiz
NAVFAC	Naval Activity Puerto Rico
BRAC PMO SE	Public Works Department
4130 Faber Place Dr. Suite 202	Building 31, 2nd Floor
N. Charleston, SC 29405	Ceiba, PR 00735
843-743-2124	787-865-4152 x459
mark.e.davidson@navy.mil	ruizp@napr.navy.mil

3.2.2 CH2M HILL

Project Manager: Thomas M. Roth, P.E.
Health and Safety Manager: Michael Goldman/ATL for General and George DeMetropolis/SDO for Munitions Response
Field Team Leader: Tim Garretson/JAX
Site Safety Coordinator: Tim Garretson/JAX
UXO Safety Officer (UXOS): TBD

The SSC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

SENIOR UXO SUPERVISOR/DIVING SUPERVISOR

Name: TBD
Company/Office: USA Environmental
Cellular Number: TBD

As the Diving Supervisor, the Senior UXO Supervisor (SUXOS)/Diving Supervisor coordinates and oversees all UXO diving operations in accordance with the requirements of the Work Plan and Dive Plan.

The SUXOS/Diving Supervisor is responsible for the execution of all onsite activities in the EZ. The SUXOS/Diving Supervisor will be responsible for overseeing scheduling and ensuring that field activities are performed in accordance with the specified plans. The SUXOS/Diving Supervisor will be familiar with all aspects of H&S as related to MEC and will coordinate with the UXOSO to ensure H&S of site personnel, the public and the environment. The SUXOS/Diving Supervisor reports directly to the Project Manager and is responsible for:

- Directly controlling the operations of all field teams performing MR activities.
- Monitoring the MR field team daily performance.
- Assisting the MR field team in achieving maximum operational safety and efficiency.
- Implementing the approved work plans in the field.

- Supervising the MR team on the project.
- Temporarily stopping work to correct an unsafe condition or procedure.

UXO QUALITY CONTROL SPECIALIST (UXOQCS)

- Name: TBD
- Company/Office: TBD
- Cellular Number: TBD

The UXOQCS will also act as the UXO Safety Officer (UXOSO). The UXOQCS is under the oversight of the MR Quality Manager and is responsible for:

- Ensuring that the overall QC procedures and objectives of the project are met.
- Reviewing and ensuring that the Quality Control Plan (QCP) addresses all project-specific QC needs and that all appropriate QC requirements are addressed.
- Implementing the MEC-specific sections of the QC Program for all MR-related evolutions.
- Conducting QC inspections of all MEC and explosives operations for compliance with established procedures.
- Directing and approving all corrective actions to ensure that all MR-related work complies with contractual requirements.
- Temporarily stopping work to correct an unsafe condition or procedure.
- Reporting independently of project management to the Corporate MR Safety and QC Officer.
- Exceeding the requirements of the Department of Defense Explosive Safety Board (DDESB)-approved UXO Personnel Training and Experience Hierarchy.

UXO SAFETY OFFICER

The UXOSO will also act as the UXOQCS. The UXOSO for this project is under the oversight of the MR Safety Manager, reports directly to the Project Manager and oversees all UXO safety and health aspects for this site. He/she will coordinate all daily activities with the Project Manager. The UXOSO will have the following responsibilities;

- Has STOP WORK authority for UXO safety and health reasons;
- Implement and enforce the HASP, and report safety violations to the Project Manager and other appropriate personnel;
- Establishing work zones and controlling access to these zones;
- Conduct daily UXO Safety Briefings;
- Implement and document the Site Specific Hazard Information Training Program;
- Consulting with the SUXOS as necessary;
- Assisting in the continued development of this Avoidance Plan, and the HASP and other safety and health procedures, as applicable;

- Investigate and report accidents/incidents and 'near misses;"
- Conduct visitor orientation;
- Enforce the "buddy" system;
- Restrict site personnel from site activities if they exhibit systems of alcohol or drug use or illness, and continually monitor site personnel for signs of environmental exposure or physical stress;
- Maintain the site safety and monitoring logs;
- Maintains an alternate line of communication with the Project Manager.

DIVER/UXO TECHNICIAN II

All Diver/UXO Technician IIs are required to comply with the provisions of this Avoidance Plan, the HASP, the WP and all applicable Federal, State and local regulations. They will report to the SUXOS/Diving Supervisor.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-215, *Subcontractor, Contractor, and Owner*)

MEC Subcontractor: USA Environmental, Inc.
Subcontractor Contact Name: Don Shaw
Telephone: 813-343-6406

The subcontractors listed above are covered by this HASP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.

- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-117, *Personal Protective Equipment, HS-121, Respiratory Protection*)

- PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.
- A PPE assessment has been conducted by the HSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the HSM or designee.
- Employees must be trained to properly wear and maintain the PPE.
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area.
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner.
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage.
- PPE must be maintained in a clean and reliable condition.
- Damaged PPE shall not be used and must either be repaired or discarded.
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the HSM so this table can be updated.

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
General site entry	D	Work clothes; steel-toe or composite-toe, leather work boots; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
Soil Sampling Any function in this HASP where potential dermal contact with site COCs is <u>limited to the hands only</u>	Modified D_1	Work clothes or cotton coveralls **Boots:** Steel-toe, chemical-resistant boots OR steel/composite-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses Face Shield (as required for splash hazards) Ear protection [d]	None required
Any function identified in this HASP where potential dermal contact with site COCs is <u>NOT</u> limited to the hands only	Modified D_2	**Coveralls:** poly coated or uncoated Tyvek© chemical resistant disposable coveralls. Poly coated will be used for exposure to liquid chemicals or other dangerous splash hazards. **Boots:** Hard toe work boots that provide sufficient ankle support	Hardhat [c] Safety glasses Face Shield (as required for splash hazards) Ear protection [d]	

PPE Specifications [a]				
Task	**Level**	**Body**	**Head**	**Respirator [b]**
		(preferable leather); with outer rubber boot covers or hard toe chemically resistant rubber boots with steel shank.		
Contact HSM prior to implementing Level C PPE upgrade	C	**Coveralls**: Polycoated Tyvek© **Boots:** Steel-toe, chemical resistant boots or steel/composite-toe , leather work boot with rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical resistant nitrile gloves.	Hardhat [c] Safety glasses Face Shield (as required for splash hazards) Ear protection [d]	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent, as applicable to appropriate respiratory protection measures for specific site compounds.

Reasons for Upgrading or Downgrading Level of Protection	
Upgrade[f]	**Downgrade**
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decrease the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SSC.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HASP, contact the HSM.

[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-207, *Exposure Assessment for Airborne Chemical Hazards*)

5.1 Air Monitoring Specifications

Air monitoring is not required for the activities covered by this HASP.

5.2 Calibration Specifications

Air monitoring is not required for the activities covered by this HASP.

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

None anticipated.

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM: Michael Goldman/ATL
Other: George DeMetropolis/SDO

6 Decontamination

(Reference CH2M HILL SOP HS-506, *Decontamination*)

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel	Sample Equipment
• Boot wash/rinse • Glove wash/rinse • Outer-glove removal • Body-suit removal • Inner-glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower ASAP • Dispose of PPE in municipal trash, or contain for disposal • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	• Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal

6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure B-4 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

7 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent material and disposed of properly.

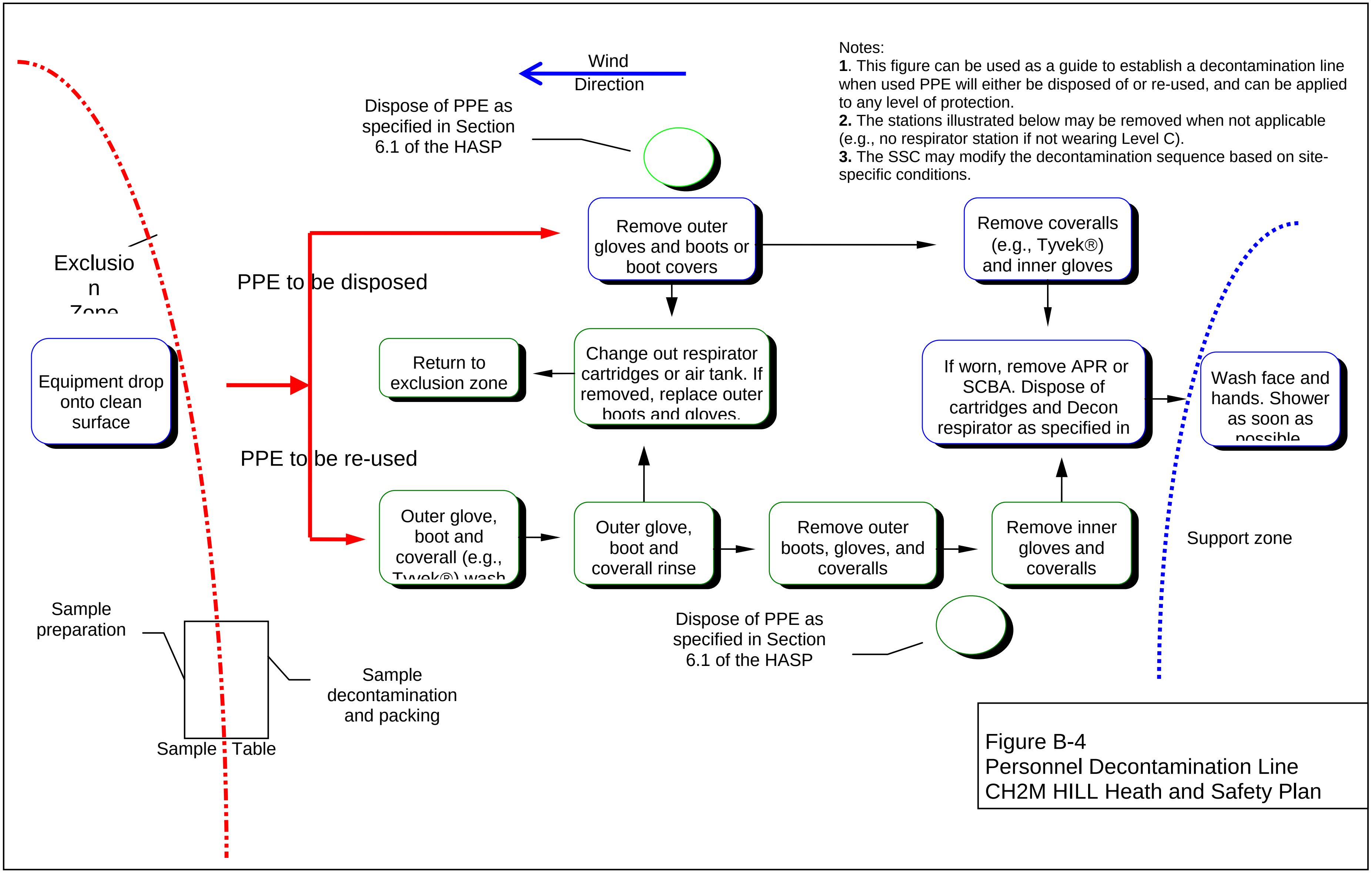


Figure B-4
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-510, *Site Control)*

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 UXO Site Control

The SUXOS/Diving Supervisor coordinates access control and security on site. Due to the hazardous nature of MEC work, only authorized personnel will be allowed in the exclusion zone (EZ). The EZ is the work site encompassing an area large enough to prevent personnel injuries from fragmentation and overpressure resulting from either an unintentional or intentional detonation of MEC.

During all intrusive operations the EZ will be a radius of 71 feet minimum (66-mm M7A2 Light Anti-Tank [LAW] Rocket). During UXO operations, only UXO trained or authorized essential personnel and authorized visitors are allowed in the EZ. The UXOSO will be responsible for conducting an operational risk management assessment in accordance with

Office of the Chief of Naval Operations Instruction 3500.39 (2010) prior to initiating response actions involving MEC at the site. In addition, the UXOSO will determine the maximum number of persons (essential personnel and authorized visitors) that can be in the EZ at one time. The ratio of UXO-qualified escorts to visitors will be determined by the UXOSO based on this site-specific operational risk analysis. Based on the risk posed by the MR operation underway, the UXOSO may decide that access to the EZ is unsafe for visitors. However, every effort will be made to accommodate the authorized visitor's needs.

With concurrence of the Project Manager, the UXOSO will grant EZ access to authorized visitors, including representatives of USEPA, EQB, and other regulatory agencies. Access to the site will be based upon the operational risk analysis of the scheduled MEC operations and availability of escorts, as well as a demonstrated visitor need and subsequent completion of visitor safety briefings.

Persons requiring access to the EZ must demonstrate a legitimate need for access and obtain authorization from the responsible project manager and UXOSO. At a minimum, the request for authorization will include: names of the individual requesting access, the identification of emergency contacts for these individuals, purpose of visit; task(s) to be performed; and rationale to support EZ access. Persons requesting access will submit their request to the Project Manager and UXOSO prior to the proposed date of the site visit. This advance notice will allow time for the UXOSO to support the visit request by assigning a qualified escort, conducting an operational risk analysis on the operations planned for the date of the site visit, and preparing a visitor site-specific safety briefing for the planned operations.

Prior to entry, all authorized visitors will receive a site-specific safety briefing describing the specific hazards and safety procedures to be followed within the EZ for operations underway that work day. Each authorized visitor will be required to acknowledge receipt of this briefing in writing.

Authorized visitors to the EZ will be escorted at all times by a UXO-qualified person. Any authorized visitor who violates the established safety procedures will be immediately escorted out of the EZ and/or site for his or her own protection and to protect essential personnel working at the site.

During all operations on site, the SUXOS/Diving Supervisor will cease operations if non-essential personnel are observed within the operating area (EZ). During duty hours, personnel will provide security at the site. Equipment will be returned to a designated area and secured at the end of each work day. Future site control measures to ensure safety are as follows;

- Eating, drinking and smoking are prohibited except in designated areas;
- MEC operations will cease if non-UXO trained or non-essential personnel are present;
- The UXOSO will escort all authorized visitors to the site;
- The UXOSO will maintain the site entry control log to ensure accurate accountability of personnel;

- The UXOSO will brief this UXO Avoidance Plan to all personnel entering the site to inform them of the potential site hazards. All personnel will acknowledge this briefing by signing the briefing log;
- In case of an emergency, personnel will exit the site and move to the designated safe area. The safe area will be located upwind of the site and outside of the fragmentation (420 feet) area. The UXOSO, with the assistance of SUXOS/Diving Supervisor, will determine the severity of the emergency. If the emergency warrants evacuation, the UXOSO will notify the Project Manager.

8.3 HAZWOPER Compliance Plan

(Reference CH2M HILL SOP HS-220, *Site-Specific Written Safety Plans*)

Certain parts of the site work are covered by state or federal HAZWOPER standards and therefore require training and medical monitoring. Anticipated HAZWOPER tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-HAZWOPER tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-HAZWOPER-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-HAZWOPER-trained personnel are allowed on the site, or while non-HAZWOPER-trained staff are working in proximity to HAZWOPER activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-HAZWOPER-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-HAZWOPER-trained personnel of the:
  - nature of the existing contamination and its locations
  - limitations of their access
  - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-HAZWOPER-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-HAZWOPER-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the HAZWOPER standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only HAZWOPER-trained personnel (minimum of 24 hours of training) will be permitted to enter the site. All non-HAZWOPER-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-106, *Emergency Response*)

9.1 Pre-Emergency Planning

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate. **Attachment 4** contains all the emergency contacts needed for the SSC to call in the case of injury, emergency, or evacuation.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone
First aid kit	Support Zone
Eye Wash	Support & Decon Zone
Potable water	Support & Decon Zone
Bloodborne-pathogen kit	Support Zone
Additional equipment (specify):	

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Attachment 4 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.

- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation route(s) and assembly area(s) will be designated by the SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

10 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: Lael Feist/HSV
Tom Roth/ATL

Date: January 3, 2011

Approved By: Michael Goldman

Date: January 10, 2011

10.2 Revisions

Revisions Made By:

Date:

Revisions to Plan:

Revisions Approved By:

Date:

10.3 Revisions

Revisions Made By:

Date:

Revisions to Plan:

Revisions Approved By:

Date:

11 Attachments

Attachment 1: Employee Signoff Form – Field Safety Instructions

Attachment 2: Project-Specific Chemical Product Hazard Communication Form

Attachment 3: Chemical-Specific Training Form

Attachment 4: Emergency Contacts

Attachment 5: Project H&S Forms/Permits

Attachment 6: Project Activity Self-Assessment Checklists

Attachment 7: Applicable Material Safety Data Sheets

Attachment 8: Safe Work Observation Form

Attachment 0: Activity Hazard Analyses/Pre-Task Safety Plan

ATTACHMENT 1

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HASP, have read and understood it, and agree to abide by its provisions.

Project Name: CLEAN III CTO-JM03/ Underwater Investigation Piñeros Island, PR **Project Number:** 400714

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

ATTACHMENT 2

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: CLEAN III CTO-JM03 / Underwater Investigation Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Project Number: 400714

MSDSs will be maintained at the following location(s):

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container Labels	
				Identity	Hazard
Alconox/Liquinox	< 1 Liter	Support/Decon Zones			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

ATTACHMENT 3

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #: 400714
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

ATTACHMENT 4 - EMERGENCY CONTACTS

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured person. Notification MUST be made within 24 hours of the injury.

24-hour CH2M HILL Emergency Number 1-866-893-2514

Medical Emergency – 911 or Hospital #: (787) 863-0505 Ambulance #: 911 LEPC (Poison Control)#: (800) 222-1222	**CH2M HILL Medical Consultant** 1-866-893-2514
Fire/Spill Emergency – Not Available Onsite	**Local Occupational Physician**
Coast Guard Search & Rescue Rescue Coordination Center, San Juan Sub-Center 911 or 787-289-2042	
Security & Police – Not Available Onsite	**Corporate Director Health and Safety** Name: Keith Christopher/WDC Phone: 703-376-5111
Utilities Emergency - NA Water: Gas: Electric:	**Health and Safety Manager (HSM)** Name: Michael Goldman/ATL Phone: 770-604-9182 x54133 Cell: 770-331-3127
Site Safety Coordinator (SSC) Name: TBD Phone:	**Regional Human Resources Department** Name: Janie Kovac/HOU Phone: 281-721-8496
Project Manager Name: Tom Roth Phone: 404-259-6674 (cell)	**Corporate Human Resources Department**
Federal Express Dangerous Goods Shipping Phone: 800/463-3339 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation and Auto Claims**

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: TBD	**Evacuation Assembly Area(s):** TBD by the SC-HW; will probably be the local hotel where the field team is staying

Facility/Site Evacuation Route(s): Go to the beach landing area for the work zone you are at (north beach, south beach, or west beach) and wait for boat transport to arrive onshore.

Route to Hospital:

The hospital route directions are from Puerto del Rey Marina.

For non-life-threatening emergencies, injured personnel should be transported to Puerto del Rey Marina on the subcontracted boat.

If the injury is critical, an ambulance should be contacted (call 911) and asked to meet the boat at Puerto del Rey Marina.

For life-threatening injuries or if the injured party cannot be safely moved, Coast Guard response should be requested (call 911).

- **Exit Puerto del Rey Marina and drive North on Route 3 toward Fajardo.**
- **After entering town, go past the Del Este Shopping Center on the right.**
- **Turn right onto Avenida El Conquistador.**
- **Proceed approximately ½ mile and turn right onto Avenida General Valero (Route 194).**
- **The hospital will be on your right.**

Local hospital: Hospital San Pablo del Este
Avenida General Valero, 404, Fajardo PR 00738

Tel: (787) 863-0505
Fax (787) 860-8514

Local ambulance service: 911

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project H&S Forms and Permits

To be completed as needed for task specific operations.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Project Activity Self-Assessment Checklists
(Not Applicable to Activities on this Project)

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Applicable Material Safety Data Sheets

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 8

Safe Work Observation Form

CH2MHILL

Safe Work Observation Form		
Project:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	**Safe**	**At-Risk**	**Observations/Comments**
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			

Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 9

Activity Hazard Analyses and Pre-Task Safety Plan

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Mobilization/Site Preparation	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the boat/work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices.	Standard Level D PPE * * Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.
	Manual Lifting	• CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D PPE
	Noise	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regiment to avoid heat stress symptoms and overexertion.	Standard Level D PPE (light colored clothing)
	Biological	• Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. **Notify supervisors of known allergies to stinging insects and location of antidotes.** • Use insect repellant. Tape pant legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens	Standard Level D PPE

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Mobilization/Site Preparation	Electric Hazards	• If/when electrical extension cords are required to complete work, extension cords must be: - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area.	Standard Level D PPE
	Other	• Shut down operations in heavy rain and lightning. • Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices.	NA

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension cords if used.	• Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

	PRINT	SIGNATURE	
Supervisor Name:	____________________	____________________	**Date/Time:**____________
Safety Officer Name:	____________________	____________________	**Date/Time:**____________
Site Personnel:	____________________	____________________	**Date/Time:**____________
	____________________	____________________	**Date/Time:**____________
	____________________	____________________	**Date/Time:**____________
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	____________________	____________________	**Date/Time:**____________
	____________________	____________________	**Date/Time:**____________

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico ACTIVITY HAZARD ANALYSIS – Soil Sampling			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Soil Sampling	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices.	Standard Level D PPE * * Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.
	Manual Lifting	• CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D PPE
	Noise	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regiment to avoid heat stress symptoms and overexertion.	Standard Level D PPE (light colored clothing)
	Biological	• Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. **Notify supervisors of known allergies to stinging insects and location of antidotes.** • Use insect repellant. Tape pants legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens	Standard Level D PPE

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico ACTIVITY HAZARD ANALYSIS – Soil Sampling			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Soil Sampling (Continued)	Electric Hazards	• If/when electrical extension cords are required to complete work, extension cords must be: - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area.	Standard Level D PPE
	Chemical Exposure	• All personnel performing this task shall be trained in accordance with 29CFR1910.120 and be deemed "fit for duty" by a licensed occupation physician. • Follow PPE and action level requirements identified in the site specific HSP. • Do not allow dermal contact or incidental ingestion of impacted soil or groundwater. Skin contact with contaminated water, soils, debris, or equipment shall be avoided at all times. Do not kneel or step in potentially contaminated media (soil or ground water). • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Following sample collection, sample container lids should be tightened securely to prevent any leaks, and the containers should be rinsed with clean water to ensure that they are free of chemical constituents.	Modified Level D_1 or D_2 PPE (see table G5-1)

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico
ACTIVITY HAZARD ANALYSIS – Soil Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Other	• Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices.	NA

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension cords if used.	• Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

	PRINT	**SIGNATURE**	
Supervisor Name:	______________________	____________________________	**Date/Time:**____________________
Safety Officer Name:	______________________	____________________________	**Date/Time:**____________________
Site Personnel:	______________________	____________________________	**Date/Time:**____________________
	______________________	____________________________	**Date/Time:**____________________
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	______________________	____________________________	**Date/Time:**____________________
	______________________	____________________________	**Date/Time:**____________________
	______________________	____________________________	**Date/Time:**____________________
	______________________	____________________________	**Date/Time:**____________________

Site Personnel (continued):

____________________	____________________	**Date/Time:**____________________
____________________	____________________	**Date/Time:**____________________
____________________	____________________	**Date/Time:**____________________
____________________	____________________	**Date/Time:**____________________
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____________________	____________________	**Date/Time:**____________________

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Demobilization/ Cleanup	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices.	Standard Level D PPE * * Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.
	Manual Lifting	• CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D PPE
	Noise	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regiment to avoid heat stress symptoms and overexertion.	Standard Level D PPE (light colored clothing)

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Demobilization/ Cleanup (continued)	Biological	• Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. **Notify supervisors of known allergies to stinging insects and location of antidotes.** • Use insect repellant. Tape pants legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens	Standard Level D PPE
	Electric Hazards	• If/when electrical extension cords are required to complete work, extension cords must be: - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area.	Standard Level D PPE

Contract Task Order JM03 – Underwater Intrusive Investigation, Pineros Island, Naval Activity Puerto Rico ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	Other	• Shut down operations in heavy rain and lightning. • Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices.	NA

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension cords if used.	• Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

	PRINT	**SIGNATURE**	
Supervisor Name:	______________________________	______________________________________	**Date/Time:**_____________ ________
Safety Officer Name:	______________________________	______________________________________	**Date/Time:**____________________
Site Personnel:	______________________________	______________________________________	**Date/Time:**____________________
	______________________________	______________________________________	**Date/Time:**____________________
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	______________________________	______________________________________	**Date/Time:**____________________

Site Personnel (continued):

____________________ _________________________ **Date/Time:**______________

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CH2MHILL

Pre-Task Safety Plan (PTSP)

Project: ________________________ Location: _______________________Date:__________________________

Supervisor: ________________________________ Job Activity:_______________________________________

____

Task Personnel:

____

____

____

____

List Tasks:

____

____

____

____

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

____

____

____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

____

Hazard Control Measures (Check All That Apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash __ FA-CPR trained personnel __ Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections: __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Cranes and rigging	Training: __ Hazwaste __ Construction __ Competent person __ Task-specific (THA) __ Hazcom
Field Notes:____ ____ ____			

Name (Print): ________________________________

Signature:________________________________ Date:__________________

Appendix C
Dive Operations Plan and NFESC Diving Operation Quality Assurance Checklist

Naval Engineering Training and Operating Procedure and Standard (NETOPS) #4-
Dive Safety

Diving is a critical operation that helps NAVFAC support the Navy's worldwide mission. Diving is also an inherently dangerous activity that must be undertaken within all prescribed requirements to help ensure the safety of our Total Force. Requirements to address the safety of our entire NAVFAC team are as follows:

- **Military and Civilian Divers –** Military and civilian divers supporting Navy execution must:
  - Graduate from an official Navy dive school
  - Hold up-to-date dive qualifications
  - Dive in accordance with OPNAVINST 3150.27B, SECNAVINST 12000.20B and the Navy Dive manual.

    NOTE: For Navy military and civilians, sport dive certifications (PADI, NAUI, SDI, YMCA, etc) are not acceptable for meeting the minimum education and training requirements. There are no exceptions.
- **Contract Divers –** Contract divers supporting NAVFAC execution must:
  - Dive in accordance with the Army Corps of Engineers (ACOE), EM 385-1-1, Section 30, Contract Diving Operations. This section describes the training, equipment, submittal, manning and operational requirements with which the contractor must comply.
- **Oversight of Contract Divers -** Those overseeing NAVFAC contracted dive operations must:
  - Be permanently approved by the NAVFAC Ocean Facilities Program Office as a District Diving Coordinator (DDC). Recognition results from completion of the ACOE annual 72-hour DDC training course, the next of which will be held in March 2008. Until the time when individuals may take the ACOE DDC course, temporary approval to act as a DDC will be provided on an individual basis by the Ocean Facility Program Office. Upon the offering of the course, all temporary approvals will be revoked.

NOTE: Being a diver is not a course prerequisite, nor is it a requirement for being a DDC. Additionally, the ACOE course provides distinct oversight training that makes being a Navy certified diver insufficient certification to be a DDC and oversee contractor dives.

– Oversee and provide guidance and authority to any additional diving inspectors assigned to at a given command. Diving inspectors may only be so assigned upon successful completion of the ACOE 40-hour dive inspector course, the next of which will be held in December 2007.

– DDCs and Dive Inspectors shall attend certified refresher training every four years in accordance with EM 385-1-1.

NOTE: NFESC along with several other component Commands have temporarily approved DDCs. Additional information regarding approval and available services can be obtained from Phil Vitale, philip.vitale@navy.mil, 1 (202) 433-5178, or Tony Militello, anthony.j.militello@navy.mil, 1 (202) 685-9220

Draft

Appendix C—
Underwater Intrusive Investigation
Dive Operations Plan

Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

Contract Task Order JM03
June 2011
Prepared for
Department of the Navy
Naval Facilities Engineering Command
Atlantic
and

CH2MHILL

Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

USA Environmental

APPENDIX C
DIVE PLAN

Contents

LIST OF ATTACHMENTS

Attachment 1	USA Environmental Inc. Diving Safe Practices Manual
Attachment 2	Standard Operating Procedures (SOPs)
Attachment 3	Activity Hazard Analysis (AHA) Forms

Acronyms and Abbreviations

APP	Accident Prevention Plan
AHA	Activity Hazard Analysis
ARAR	Applicable or Relevant and Appropriate Requirement
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BRAC	Base Realignment and Closure
CAP	Corrective Action Plan
CAR	Corrective Action Request
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action—Navy
DDC	District Diving Coordinator
DDESB	Department of Defense Explosives Safety Board
DGM	digital geophysical mapping
DGPS	differential global positioning system
DMM	Discarded Military Munitions
DNER	Department of Natural and Environmental Resources
DOD	Department of Defense
DoDI	Department of Defense Instruction
DOT	Department of Transportation
DP	Dive Operations Plan
DQO	Data Quality Objective
DS	Diving Supervisor
EIS	Environmental Information Specialist
EOD	Explosive Ordnance Disposal
ESQD	Explosives Safety Quantity Distance
ESS	Explosives Safety Submission
EZ	Exclusion Zone
°F	Degrees Fahrenheit
FSW	Feet of Salt Water
GIS	Geographical Information System
GPS	Global Positioning System
HE	High Explosive
HERO	Hazards of Electromagnetic Radiation to Ordnance
HFD	Hazardous Fragmentation Distance
HSM	Health and Safety Manager
HSP	Health and Safety Plan

in/ft	Inches per foot
LAW	light anti-tank weapon
MC	munitions constituents
MD	munitions debris
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MFD	maximum fragment distance
MGFD	munition with the greatest fragmentation distance
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MRS	munitions response site
MRSIMS	munitions response site information management system
NAPR	Naval Activity Puerto Rico
NAVFAC	Naval Facilities Engineering Command
NAVSCOLEOD	Naval School Explosive Ordnance Disposal
NEW	net explosive weight
NOSSA	Naval Ordnance Safety and Security Activity
OD	Open Detonation
OSHA	Occupational Safety and Health Administration
PM	Project Manager
PMO SE	Project Management Office Southeast
PPE	Personal Protective Equipment
PR	Puerto Rico
QA	quality assurance
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
QC	quality control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPM	Remedial Project Manager
SCUBA	Self Contained Underwater Breathing Apparatus
SI	Site Inspection
SM	Site Manager
SOP	Standard Operating Procedure
SSC	Site Safety Coordinator
SUXOS	Senior Unexploded Ordnance Supervisor
TBD	to be determined

TP	Technical Paper
TSD	team separation distance
USA	USA Environmental, Incorporated
USEPA	U.S. Environmental Protection Agency
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USMC	U.S. Marine Corps
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
UXOTI	Unexploded Ordnance Technician I
UXOTII	Unexploded Ordnance Technician II
UXOTIII	Unexploded Ordnance Technician III
WP	Work Plan

SECTION 1

1 Introduction

USA Environmental (USA) prepared this Dive Operations Plan (DP) for CH2M HILL under a Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico (NAPR) for the Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC), and Base Realignment and Closure (BRAC) Program Management Office Southeast (PMO SE). The current phase of work is being performed under the Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000 Program, Contract No. N62470-08-D-1000, Contract Task Order JM03.

This project DP describes the duties of onsite dive team members, the diving equipment and platform, the nature of work to be performed (including tools and materials to be handled), anticipated surface and underwater conditions (visibility, temperature, currents, etc.), maximum single dive bottom times for the planned depth of dive for each diver, and the topside support for the dive team.

1.1 Background and Project Objective

This DP is an appendix to the *Work Plan to Conduct Phase I RFI, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* (CH2M HILL, 2006). Field investigations conducted in 2006 under that Work Plan resulted in the identification of geophysical anomalies representing potential munitions and explosives of concern (MEC) at terrestrial and underwater (UW) locations.

1.2 Scope and Organization

The primary purpose of underwater operations is to complete an investigation for MEC located both on and below the surface of the seafloor. The designated region for underwater operations at each site will commence at the shoreline and extend seaward as shown in **Figures 3-1, 3-2 & 3-3** of the Work Plan.

Underwater operations will be completed through the utilization of divers, additionally qualified as UXO Technicians Level II or above, with Self Contained Underwater Breathing Apparatus (SCUBA).

This DP and attachments present the detailed approach to be used for implementing the MEC investigation activities in the suspected underwater demolition areas. The project objectives will be accomplished through the performance of the following activities:

- Intrusive investigation of 10 percent of each underwater investigation area, shown on **Figure 1-2** of the Work Plan.
- Documentation of coral and sea grass locations within and adjacent to 100% of each underwater investigation area for use in biological assessments in the event that underwater demolitions are needed during a future phase of work.

- Removal of MEC and material potentially presenting an explosive hazard (MPPEH) that is safe to move and land-based demolition and disposal, if necessary. (MEC/MPPEH that is not safe to move will be left in place and a determination on the final disposition will be made in conjunction with the Navy.) All such actions will be performed in accordance with the approved Explosives Safety Submission (ESS) for this project.

1.3 Site Location and Description

Section 1.3 of the Phase I RFI Work Plan (CH2M HILL, 2006) provides detailed information on the site location and description. This DP addresses three underwater investigation areas, each of which is comprised of a suspected underwater demolition area and the seafloor between this area and the nearest beach, as shown on **Figure 1-2** of the Work Plan. These areas were selected for investigation based on the potential hazards posed by the suspected historical use of the areas, and because unauthorized recreational activities, such as boat anchoring, snorkeling, and scuba diving, have been observed in these areas.

A survey of the suspected underwater demolition areas was conducted in 2006 to evaluate the presence of coral species in these areas. This survey provided the following descriptions:

- Area UW-1 is in approximately 20 to 25 feet of water. In 2006, the seafloor consisted mainly of sand with little to no coral.
- Area UW-2 is in approximately 15 feet of water. In 2006, the seafloor consisted mainly of sand and turtle grass (*Thalassia testudinum*) interspersed with occasional corals. A small 15-foot-wide by 15-foot-long by 5-foot-high mounded section of hard coral (likely lettuce coral [*Agaricia agaricites*]) was situated along the southern border of the UW-2. Outside the northwestern corner of UW-2, a large piece of dead Elkhorn coral (40 feet wide by 40 feet long by 10 feet high) was found that fire coral (*Millepora sp.*), sea fans (*Gorgonia sp.*), and sea whips (*Leptogorgonia sp.*) had colonized. The dead Elkhorn coral reef had heights that were within 5 feet of the water surface and required avoidance by boats.
- Area UW-3 is in less than 8 feet of water. In 2006, the seafloor was covered by sand and turtle grass. No coral formations were observed in this area. The southwestern portion of UW-3 had apparent debris representing potential MEC/MPPEH items on the seafloor that was not investigated further.

There is a fourth suspected underwater demolition area, Area UW-4, that is located off the northern point of Cabeza de Perro in water 25 feet deep along the southern edge near the island to greater than 35 feet deep along the northern edge. This area is not addressed under this investigation because the conditions in this area, including deep water, lack of adjacent beaches, and the inaccessibility to Cabeza de Perro, make it unlikely that unauthorized recreational uses will be made of this area.

1.4 Site History

Section 1.4 of the Phase I RFI Work Plan (CH2M HILL, 2006) provides a detailed history of Piñeros and Cabeza de Perro Islands.

Beginning in the late 1950s, Piñeros and Cabeza de Perro Islands were utilized by U.S. Special Warfare Group Two, Unit Four (SPECWAR) personnel for various training activities. Piñeros exercises included beach landings combined with sea-to-land firing and underwater demolition on offshore coral reefs; no specific information was related to Cabeza de Perro.

Before 1987, training activities took place on all parts of Piñeros Island and in near offshore shallow waters around Piñeros and Cabeza de Perro Islands. Approximately 300 men, in groups of 50, were trained each year in underwater diving and demolition techniques. Underwater demolitions teams used two beaches on the northern coast of Piñeros to practice detonating up to 500 pounds of underwater demolition charges. Training on the south shore included setting up explosive charges for detonation, which had an emplacement of 12 to 15 obstacles in the surf zone and shoal waters just off the beach.

History of MEC use within the near shore waters of Cabeza de Perro Islands remains unknown; there are no reports to confirm MEC use. However, underwater areas UW-1 through UW-4, shown on **Figure 1-1** of the Work Plan**,** were defined as sites of suspected former underwater demolition training based on historical maps.

1.4.1 Climate

The weather at Piñeros and Cabeza de Perro Islands is generally warm year round due to its tropical marine climate. Average rainfall is approximately 36 inches, with the heaviest rain in May, September, October, and November. The months of August through November are considered the wet season, and the driest months are January through April. Daily temperatures average 80°F year round with an average maximum of 86°F and an average low of 74°F. Prevailing winds are generally from the east-northeast during November through January and from the east during February through October. Wind speeds average 8 knots. Hurricane season is from June through November, and severe hurricanes hit Piñeros and Cabeza de Perro Islands every 10 to 20 years.

1.4.2 Water Conditions

Anticipated water surface and subsurface conditions consist of the following:

- Water temperature range from 78-81 °F in winter months to 82-84 °F in summer months
- Tidal range from 0.5 to 2 feet
- Underwater visibility from 15-60 feet
- Currents- see description below
- Surface conditions- see description below

Given the varying geographic locations of the waterborne areas for each suspected underwater demolition area, current and surface wave conditions will fluctuate based on the time of day, the winds direction and speed and changes in tides.

Surface Current Generated by Wind. Wind-generated surface currents are temporary and depend on the force, duration, and fetch of the wind. If the wind has been blowing steadily for some time, this current should be taken into consideration especially when planning surface swims and SCUBA diving. A SCUBA diver is severely handicapped by currents greater than 1.0 knot.

The prevailing winds emanating from the east-northeast typically result in windward sites having more robust wave action than those on the leeward side of the islands. However, all of the intended dive sites are limited to shallow water zones close to the shoreline, resulting in many of these sites being located in protected lagoons or bounded by reef structures. These natural conditions can minimize the size and frequency of wave action moving through the area.

1.4.3 Sensitive Underwater Habitat

Each dive site may contain sensitive underwater natural resources consisting of corals, turtle grasses, and a collection of fish, turtles, and other species.

The federally and state-listed waterborne species of most concern are the green sea turtle, hawksbill sea turtle, leatherback sea turtle, and loggerhead sea turtle. In addition, the Elkhorn and Staghorn corals in the surrounding waters are threatened species.

It is anticipated that the presence of these species may impact the extent of underwater operations.

1.5 Previous Investigations

The WP and the *Draft Phase I RFI Report - Terrestrial Investigation, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* (CH2M HILL, 2010c) have detailed accounts of the findings in previous terrestrial investigations. These investigations resulted in the following list of munitions and demolition materials used on the island or in the surrounding waters that could potentially be encountered while conducting underwater operations:

- Projectiles
- Rockets
  66mm M72A2 light anti-tank weapon (LAW) rocket (remnants confirmed)
- Grenades
  40mm, practice, including M382, M385, M407, M781
  Hand, Fragmentation, including MK II, M33, and M67
  Hand, Offensive, MK3
  Hand, Incendiary, TH3, AN-M14
  Hand, Illuminating, MK1
  Hand, Smoke, including AN-M8 Series and M18 series
  40mm, Smoke, including M676, M680, M682
  40mm, Parachute, M583, M661, and M662
  WP, Grenades including M15, M34
- Explosives
  C-3
  C-4
  TNT
  20-lb. crater charges
  40-lb. crater charges
  Military Dynamite (M-1)
  Claymore mines (training)
  Detonation cord
  Electric and non-electric blasting caps
  Chemical delay blasting caps
  Limpet mines with Mk48 timers

Explosive fasteners

- Pyrotechnics
  M583A1 star shells
  37mm star flares
  Signal, Illumination, Ground, M187, M188, M189
  Signal, Illumination, Ground, White Star, M127
  Signal, Illumination, Ground, Red Star, M126
  Signal, Illumination, Ground, Green Star, M195

Depending on the length of time a MEC item has been submerged in a saltwater environment, and the resulting condition of the exterior body, specific recognition of the item may be inhibited. This includes recognition of the type, model, fuzing configuration, and fired or unfired status.

SECTION 2

2 Diving Operations

All diving operations will be conducted in accordance with this Dive Operations Plan, Occupational Safety and Health Administration 29 Code of Federal Regulations (CFR) 1910, Occupational Safety and Health Requirements; U.S. Army Corps of Engineers' *Engineer Manual (EM) 385-1-1, Safety and Health Requirements* (U.S. Army Corps of Engineers, 2003), *U.S. Navy Diving Manual* (U.S. Navy, 2005), and USA Environmental, Incorporated (USAE)'s *Safe Diving Practices Manual* (USAE, 2008). A listing of the applicable references is listed in Section 4 of this DP.

2.1 Description of Intended Operations

All UW related field activities will be performed under this task. The field investigation will be conducted in phases during the months of August and September of 2011. The primary field investigation activities include:

- Mobilization and Site Setup
- Underwater Transect Layout
- Underwater MEC Investigation, "Detect and Dig"
- Manual Excavation of Anomalies
- Transfer of MEC/MPPEH
- Disposal of MEC/MPPEH
- Site Shut down and Demobilization

2.1.1 Mobilization and Site Setup

Under this Phase, USA will ensure mobilization of all personnel and equipment is completed.

USA also plans to complete one or two days of training for the dive team and boat crew, which will include a familiarization dive. This will be to become familiar with and test equipment, learn the conditions of the waters around the site, and conduct emergency drills, all of which will enhance the production and safety of the team.

2.1.2 Underwater Transect Layout

Under this Phase USA will conduct the following UW operations.

- Layout of underwater transects using MEC avoidance procedures

All diving operations will be from a moored vessel within the three UW areas surrounding Pineros Island. The vessel will be moored using 50 pound sandbags, two or more if needed, lowered in a hand over hand fashion to the sea floor. When a USAE diver is completing the Transect Layout that only one USAE diver will be in the water at one time. This diver will be tended using a no less than 3/8 inch diameter line. The diver will be visually monitored by personnel on the vessel and through the use of water wireless communications.

Anomalies and transects have been identified in each of the three UW areas (***Figure 1-1*** through ***Figure 3-4***) of the WP. Transect layout in the three suspected former UW demolition areas will be completed by boat and the UXO Dive team. The transects are spaced 56 feet apart and for each one a six-foot search area will be completed. Table 2-1 shows the acreage in each UW area the transects cover.

Table 2-1

Area	Transects (acres)
UW-1	0.86
UW-2	0.96
UW-3	0.57
TOTAL:	2.39

In order to avoid anomalies during the setting of clumps/anchors for transect lines and locate subsurface anomalies for intrusive investigation USA intends to use Whites Dual Pro PI underwater all-metals detector. The Whites underwater all-metals detector will be used for detection of anomalies below the surface of the sand and is water proof to 100fsw.

The standard Whites Dual Pro PI system consists of a single-coil oval search head, a telescopic handle, audio headset, processing electronics, and batteries. The Whites Dual Pro PI transmitter generates a pulsed primary magnetic field, which then induces eddy currents in nearby metallic objects. The Whites Dual Pro PI is capable of detecting ferrous and non-ferrous items. Audio output from the device will be observed by a UXO-qualified diver/operator to detect, in real time, ferrous and non-ferrous items on and beneath the surface of seafloor sediments. The sound frequency is relative to the amplitude of the response of the system. The diver will listen to the audible sound output by the system to identify anomaly locations. Once an anomaly is identified, the diver will intrusively investigate the anomaly using the methods described in **Section 2.1.3**.

The Whites underwater all-metals detector will be tested daily on the beach adjacent to the work site for the day in accordance with Section 4.4.1 of the Work Plan utilizing an item the size of a 40mm grenade or equivalent buried to a depth no greater than 5 to 7 times its diameter.

Utilizing a hand held GPS, the beach set up team will locate the corners of the transects on the beach, the coordinates are provided on each UW figure in the WP. Once a corner or transect end point has been located, a UXO Tech will use the all metals detector and avoidance procedures to ensure the area where the transect anchor will be placed is free of any anomalies. A Danforth-type anchor or equivalent will be placed as a set point in the sand for the beach side of the corner and the transects. Each transect end on the beach side will be set using the same technique. The UXO Tech will remain on the shore to assist in running the transect lines.

The boat team will begin setting the at-depth corner and transect locations from the surface. Utilizing a GPS, the boat will position itself over the location for the clump to be placed. Once ready the Diving Supervisor (DS) will deploy two UXO Divers.

- The divers will descend to the area where the clump is to be placed, and utilizing the all metals detector, the divers will ensure the area where the clump will be placed is free of any anomalies through visual and detector-assisted survey within a 5-foot x 5-foot area.

- Once the divers complete the search they will surface.
- Once the divers are on the surface the boat team will slowly lower the 50-lb sandbag clump, in a hand over hand fashion, until it is on the bottom. Clumps placed at depth will have marker floats attached to them so they are visible from the surface of the water. There will also be a running line attached to the clump, once laid this will be the transect line that the divers will follow.
- Once the two transect end points have been established, the divers will be deployed and descend to the clump.
- Once on the bottom, the divers will untie the transect line running end.
- The divers will payout the transect line toward the shore as they survey the sea floor ensuring there are no MEC/MPPEH items or any sensitive habitat that the transect line may get snagged on or damage. Once the divers find themselves at the shoreline, a UXO Tech on the beach will take the line from the divers and walk it into the anchor position, pull it tight and tie it off.

The above process will be completed for each transect in each UW area.

All transect lines will be placed for the specific UW area prior to completing the UW MEC investigation phase, unless it is assessed by the diving team and the contractor's management team that another approach is more feasible.

2.1.3 Underwater MEC Investigation; "Detect and Dig"

The "detect-and-dig" process will be conducted along the planned transects shown on Figure 3-2 through Figure 3-5 of the WP. Because wave action and tidal movement may have affected the final resting place of MEC/MPPEH, the historical underwater demolition areas have been expanded for the investigation. The investigation area at each suspected underwater demolition area is based on the historically identified area, plus 50 feet to the east and west and 50 feet seaward. It also extends to the high tide mark on the landward side. The planned transect design is based on 10 percent coverage of the investigation areas.

Two UXO-qualified divers, utilizing SCUBA, will complete a visual and handheld underwater metal detector investigation of the seafloor to a depth of 1 foot below the surface. Divers will advance along the transect lines, sweeping a 6-foot path with the metal detector off the transect line. In order to meet the 6-foot investigation, the sweep path will be 3 feet to either side of the transect line.

UXO-qualified diver surveying the seafloor with a Whites Dual Pro PI UW all-metals detector

When the all metals detector indicates the presence of an anomaly, or the diver identifies a potential MEC item exposed on the seafloor, it will be excavated.

As part of the QC process, the UXO QC Specialist (UXOQCS), will re-inspect 10 percent of the transects to confirm that all anomalies were detected. The locations checked will be distributed in a spatially representative sample across each investigation area.

2.1.4 Manual Excavation of Anomalies

Excavation of individual geophysical anomalies will be performed by two UXO-qualified divers using hand-excavation tools. The UXO dive team performing this work will be composed of qualified UXO Technician IIs or higher, supervised by a DS/UXO Technician III.

Initially small hand tools, such as shovels, spades, trowels, and pry bars, will be used to access potential MEC/MPPEH. Hand tools will be used for most of the items, which generally are expected to be found near the surface of the seafloor sediments. The following basic techniques will be used for anomaly excavation:

- For anomalies identified by the "detect-and-dig" technique, the source of the anomaly will be investigated.
- Until identified otherwise, the anomaly is assumed to be MPPEH. Excavation will be initiated adjacent to the subsurface anomaly. The excavation will continue until the excavated area has reached a depth below the top of the anomaly as determined by frequent inspection with the handheld all-metals detector (Whites Dual Pro PI underwater detector).
- Using progressively smaller and more delicate tools to carefully remove the sediments, the diver will expand the sidewall to expose the anomaly source for inspection and identification without moving or disturbing the item.
- Once the item is exposed for inspection, the excavation team will determine whether the item is MEC/MPPEH. The UXOSO/UXOQCS will provide visual final classification as to whether MEC is safe to move.

- If the item is MEC, it will be handled as discussed in Section 3.4 of the WP.
- If the item is not MEC, it will be removed and the area will be rechecked with the all metals detector to ensure that additional anomalous items are not hidden beneath the removed item.

The maximum depth of intrusive investigation will be 1 foot below the surface of the seafloor sediments, based on the types of munitions used and the underwater environment. If the source of an anomaly is found to be deeper than 1 foot, the anomaly identifier and location will be recorded as having a source deeper than 1 foot beneath the seafloor that was not characterized or removed.

An alternative/contingency to hand excavation procedures, is the utilization of a mechanical excavation pump/system. This may be utilized in the event that manual excavation is not suitable for site conditions.

Depending on the length of time a MEC item has been submerged in a saltwater environment, and the resulting condition of the exterior body, specific recognition of the item may be inhibited. This includes recognition of the type, model, fuzing configuration, and fired or unfired status.

2.1.5 Transfer of MEC/MPPEH

Safe–to-move MEC, MPPEH, and other debris items will be hand-carried or floated on a water craft to a terrestrial processing location on Piñeros Island. MEC, MPPEH, and other debris will be segregated before transport and will remain segregated during transport. Transportation of MEC/MPPEH is described in Section 3.4.3 of the WP.

In the event that items discovered are too large to move by hand an alternative/contingency movement plan will have to be determined on site. Alternative procedures may include but are not limited to the use of lift bags/balloons.

2.1.6 MEC/MPPEH not Safe to Move

MEC/MPPEH that is not safe to move will be left in place in accordance with Section 3.4.5 of the WP, and the geographic coordinates will be recorded using a global positioning system (GPS) (a final determination on the disposition of items left in place will be made in conjunction with the Navy at a later date.)

Upon completion of each phase, the resulting site conditions and specific situation will be assessed to determine if execution of the subsequent phase is required and can be safely conducted.

2.1.7 Site Shutdown and Demobilization

Under this Phase, USA will ensure the site is closed down and the demobilization of all personnel and equipment is complete.

2.2 Dive Profile

Given the limited distance from the shoreline of the designated investigation areas, the depth range for diving operations is 05-40 Feet of Salt Water (FSW). However, the actual depth of each dive location will be determined once the dive team is on-site and can conduct a full assessment. It is anticipated that no dive operations will be conducted at depths greater than 50 FSW.

Current Dive Profile Tables are included in the USA Diving Safe Practices Manual (Attachment 1), and will be utilized to monitor the time/depth profile of each dive. The greatest anticipated no-decompression limit and repetitive group designator for this no-decompression air dive is listed in Table 2-2:

TABLE 2-2

Depth (FSW)	Non-Decompression Limit (Min)	Repetitive Group
50	• 92	• M

At no time will any dive requiring decompression be planned or executed.

**All diving profiles, no-decompression limits and Repetitive Group Designators are based on U.S. Navy Diving Manual, Revision 6, 15 April 2008*

2.3 Dive Team

All UXO personnel assigned to the project will meet or exceed the qualifications as provided in DDESB Technical Paper (TP) 18, *Minimum Qualifications for UXO Technicians and Personnel* (DDESB, 2004). Additionally, all UXO personnel conducting underwater detection and identification of munitions must have completed both the basic and the underwater portions of Naval School Explosive Ordnance Disposal (NAVSCOLEOD) (or foreign equivalent) training.

The USA dive team will consist of at least six personnel:

- UXO DS/UXO Technician III
- UXOQCS Diver/UXO Technician III
- One tender/UXO Technician II
- Two divers/UXO Technicians II
- One standby diver/UXO Technician II.

All operations will be conducted only during daylight hours.

2.3.1 USA Diving Manager

The USA Diving Manager (DM) will provide overall management and designation of the Diving Team. The Diving Manager will also generate and submit a listing of the qualifications of all Diving Team members.

The DM is a corporate employee and is qualified to conduct the duties as the DS, however the main focus of the DM will be to ensure the Pineros Island diving operations are conducted without issue. The DM will be onsite for the kickoff of the diving operations to assist the dive team.

The Diving Team members and their qualification information will be provided for review at a later date once the Dive Team members are verified.

2.3.2 UXO Diving Supervisor

The USA UXO DS will be the operational authority and will be responsible for running all diving operations for the Piñeros underwater operations. The DS will report administratively to the USA Diving Manger, and operationally to the prime contractors SUXOS.

The USA UXO DS will have the following operations and safety/health related responsibilities:

- Manage the funding, manpower and equipment necessary to safely conduct site operations
- Review and become familiar with the site Dive Operations Work Plan, USA Diving Safe Practices Manual (Attachment 1), and the overall Piñeros Site Safety and Health Plan (SSHP)
- Ensure that all diving and support personnel review and are aware of the guidelines and procedures reflected in the Dive Operations Work Plan, USA Diving Safe Practices Manual (Attachment 1), and SSHP
- Coordinate and oversee all diving operations
- Coordinate the assignment of personnel during diving operations
- Ensure implementation of project quality and safety and health procedures
- Identify potential problem areas, including safety and health matters, and institute corrective measures
- Direct interface with the USA Diving Manager, and advise him/her of safety and health matters related to conduct of the site diving operations

The DS will determine the number of divers required to complete each task, though no more than two divers will be in the water at any time. Applicable requirements for tending the dive team will be followed, and will be dependent on the team structure, site conditions, and ensuring the safety of diving personnel. It is anticipated that two divers will be utilized for all tasks completed UW.

The USA DS will maintain a hardcopy on site of the personnel files on each employee. These records will include copies of licenses, training records and certificates of qualifications that support the employee's placement and position. Prior to the employee's initial assignment or any change in duties/assignment, the USA DS will physically review the employee's licenses, training records and certificates to ensure that the employee is qualified.

2.3.3 UXOQCS Diver

The UXOQCS is responsible for overseeing the site QC plan in all field operations as stated in Section 4.4.7 of the Work Plan. In addition to following the QC plan in the Work Plan the UXOQCS will be qualified as a UXO Diving Technician III. The UXOQCS coordinates with the contractor Site Manager and USA PM for daily operations and maintains a direct line of communication to the USA PM and Dive Supervisor and will be responsible for:

- Develop and implement the MEC-specific sections of this QCP for all explosives-related operations
- Conduct daily audits of the procedures used by MEC teams and individuals for processing MPPEH
- Perform and document random sampling (by pieces, volume, or area) of all MPPEH collected from the various teams to ensure that no items with explosive hazards, engine fluids, illuminating dials, or other visible liquid hazardous or toxic waste materials are identified as MD or range-related debris as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A
- Conduct QC audits of all explosives operations for compliance with established procedures
- Identify and verify completion of all corrective actions to ensure that all explosives operations comply with requirements
- Analyze operational risks, explosive hazards, and safety requirements
- Establish and enforce compliance with all site-specific explosives operations safety requirements
- Enforce personnel limits and safety EZs for explosives-related operations
- Conduct, document, and report the results of safety inspections to achieve compliance with all applicable explosives safety policies, standards, regulations, and codes
- Ensure that all protective works and equipment used within the EZ are operated in compliance with applicable DoD policy, DDESB approvals, and other federal, state, and local health and safety statutes, regulations, and codes
- Advising the Dive Supervisor and Project Teams on all QC-related site matters

2.3.4 UXO Diving Technicians

UXO-qualified divers/UXO Technicians II will have completed both the basic and underwater portions of NAVSCOLEOD (or foreign equivalent) training. In addition they will be able to:

- Conduct UW visual and/or detector-aided MEC field search activities
- Locate subsurface MEC by operating geophysical detection instruments and related equipment
- Perform field maintenance and tests on geophysical detection instruments and related equipment
- Remove non-hazardous MDAS and range-related debris, only after such items have been inspected by a UXO technician or UXO-qualified personnel and determined to be safe for handling
- Perform site and area security functions
- Reconnoiter and classify MEC

- Identify all types of military munitions, including possible fuzes and their condition, armed or unarmed; examples are the following:
  - -Bombs
  - -Guided missiles
  - -Projectiles
  - -Rockets
  - -Land mines and associated components
  - -Pyrotechnic items
  - -Military explosives and demolition materials
  - -Grenades
  - -Submunitions
- Perform diving operations and emergency procedures
- Determine precise locations in the field environment, using a variety of techniques such as global positioning equipment or basic land navigation using topographical map and compass
- Perform field-expedient identification procedures to identify contaminated soil
- Perform limited technical supervision of UXO sweep personnel
- Escort personnel who are not directly involved in UXO-related operations (e.g., personnel performing environmental monitoring), but who have activities to perform within exclusion zones
- Inspect MPPEH for the presence of explosive safety hazards
- Perform techniques of the assigned diving mode
- Use UW tools, equipment and systems relevant to assigned tasks
- Be trained in diving-related physics and physiology
- Be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

2.3.5 Standby Diver

A standby diver with a tender is required for all SCUBA diving operations. The standby diver will be equipped with the same equipment as the primary diver(s).

2.3.6 Standby Diver Qualifications

The standby diver is a fully qualified diver, assigned for back-up or to provide emergency assistance, and is ready to enter the water immediately. A standby SCUBA diver shall don all equipment and be checked by the DS. The standby diver may then remove the mask and fins and have them ready to don immediately for quick deployment. For safety reasons at the discretion of the DS, the standby diver may remove the SCUBA tank. The standby diver receives the same briefings and instructions as the working diver, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance. The SCUBA standby diver shall be equipped with an “octopus rig” in order to share breathing air as necessary and a tending line.

TABLE 2-3

Position	Name	Diving Equipment
Dive Supervisor	Robert Rice	N/A
Primary Diver	Mark Isabel	SCUBA
Secondary Diver	Jeff Gunn	SCUBA
Standby Diver	Vince Class	SCUBA
Quality Control (QC) Diver	Russ Kelley	SCUBA
Tender/Diver	John Stoddardt	SCUBA

Due to the unknown date of actual diving operations, the names and qualification level of diving personnel is included in this draft version of the Dive Work Plan, however the above information is subject to change. Once the actual date of the diving operations are known and a Notice to Proceed (NTP) is issued USA will provide an updated list of names and qualifications to the applicable reviewing authority as requested in the SOW.

2.3.7 Topside and Support Personnel

Personnel assigned to support diving operations consist of the following positions:

- Boat Coxswains and crew
- Dive Team Personnel

The boat coxswains and crew personnel will be provided by a local subcontractor identified to provide dive platform services.

2.4 Diving Equipment

The dive team will utilize SCUBA equipment while conducting dive operations. Each individual SCUBA diving system will be outfitted with a full face diving/breathing mask. A listing of the equipment related requirements and inspection criteria is contained in the USA Diving Safe Practices Manual (Attachment 1).

In order to complete the subsurface transect MEC investigations, divers will utilize an underwater handheld all metals detector.

SCUBA cylinders will be refilled as required by a local, recreational dive provider. The USA DS will ensure that the local facility maintains an inspection/sampling certificate for applicable air purity standards.

2.5 Dive Platforms

A local subcontractor will provide small boats as diving platforms and support craft throughout the duration of the project. The size and type of the platforms are not currently identified; however, subcontractors have been identified that have the equipment that will be needed to complete the operations. A Diving Flag will be displayed as required by EM 385-1-1.

Each dive platform will be US Coast Guard inspected/documented, and equipped with emergency first aid equipment and emergency oxygen kits.

The location of the intended dive site may also result in conducting dive operations from a land based location. The dive team will establish the dive side on a beach/land area, and maintain a vessel on site for emergency transportation purposes.

A collection of dive platforms will be used to maintain an exclusion area around each diving operation. Incoming vessels will be warned of the presence of divers, and directed away from the site.

2.6 Communication

Dive operations will require effective means of communication to complete intended tasks in a safe and efficient manner.

Prior to the commencement of each work day when diving operations are planned, the USA DS will ensure that communication (phone and VHF radio) has been established with local agencies required to support an emergency medical situation, and that necessary equipment and facilities (recompression chamber, helicopter, etc) are operating and available to provide response.

2.6.1 Diver to Surface

Divers will maintain communication to topside while conducting dive operations. The primary means of communication will be through a wireless, underwater voice communication system contained within each full face diving/breathing mask.

When tended to the surface, divers can also maintain communication through the use of line pull signals.

2.6.2 Dive Site to Support Agencies

The dive site will maintain communication with supporting agencies through use of cellular phone and marine VHF radio.

Communication with the USA Corporate office will be through cellular phone and e-mail.

2.6.3 Key Personnel

Contact information for key personnel is listed in Table 2-4.

TABLE 2-4

Position	Name	Office Phone	Cellular Phone	E-mail
USA Corporate Office	Administration	813-343-6336	N/A	N/A
USA Project Manager	Don Shaw	813-343-6406	813-846-9138	dshaw@usatampa.com
USA Diving Manager	Brian Skubin	813-343-6384	813-426-2427	bskubin@usatamapa.com
USA Corporate Safety and Health Manager	Robert Crownover	813-343-6364	N/A	rcrownover@usatampa.com

2.7 Safety

USA will routinely conduct three distinct team safety and operations meetings during execution of diving operations:

- Pre-Dive Brief
- Daily Safety Brief
- Post-Dive Debrief

The Pre-Dive Brief will be completed prior to each diving evolution, while a Daily Safety Brief will be completed prior to commencement of each work day. The DS and Senior UXO Technician/Diver will provide these briefs, highlighting both diving and MEC related safety precautions.

The briefs will focus on the specific hazards anticipated at each work site during that day's operations and the safety measures that will be used to eliminate or mitigate those hazards. Review of applicable Activity Hazard Analysis (AHA) sheets, contained in Attachment 4, will also be conducted. The briefs will also refer to other operations within the area whose proximity may have safety ramifications.

As work progresses and the team's location changes within a site, or from site-to-site, any corresponding changes in anticipated hazards or emergency procedures will be reviewed.

In addition, the DS may hold a safety stand-down at any time a degradation of safety or a safety issue that warrants a review is noted.

The Post-Dive Debrief will be completed at the conclusion of each day when diving operations were conducted, and will include applicable contact information for medical/recompression facilities and limits regarding post dive activities.

A written daily record of the Pre-Dive and Daily Safety Briefs will be maintained.

If at any time the USA personnel feel that unsafe situations are occurring, the USA personnel will not enter the water until complete resolution of the procedures or conditions are resolved.

Execution of the intended diving plan is critical to ensure the safety of all personnel. ***If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the NAVFAC District Diving Coordinator (DDC) will be contacted in order to review and accept the alteration prior to actual operation.***

2.8 Training

Prior to mobilization, all USA dive personnel will fulfill the following qualification and examination requirements:

- 40-hour HAZWOPER (or eight hour refresher/supervisor refresher)
- Cardiopulmonary Resuscitation (CPR)
- First Aid
- Use of Emergency Oxygen Resuscitation Systems
- Annual Diving Physical

As part of the mobilization process, USA will perform site specific training for all personnel assigned to this project.

The purpose of this training is to ensure that all personnel fully understand the procedures and methods USA will use to perform diving operations, to include individual duties and responsibilities, and all safety and environmental practices/procedures.

Familiarization with project specific equipment and a functional tour of each diving craft/platform will be completed, along with training on recognition and safety precautions regarding the anticipated MEC items that may be encountered while conducting diving operations.

In addition, the dive team will perform a diver injury drill during the project set-up phase to review medical response procedures and actions.

SECTION 3

3 Emergency Management Plan

3.1 Local and Regional Medical Facilities

There is no local medical facility or ambulance service available on the island of Piñeros, and injuries will be assessed and provided first aid on site or transported to a medical facility or recompression facility on the main Island of Puerto Rico. Hospital San Pablo Del Este is the nearest medical facility to the Puerto Del Rey Marina where the dive team will launch, recover and transit for emergencies. Directions to the Hospital San Pablo medical facility are:

- Located at Avenue General Valero/Pr-194, 404 Fajardo, PR 00738; Phone: (787)863-0505
- The Hospital route is identified along the major roads with signs and the Hospital itself has a sign.

ROUTE TO HOSPITAL

Any serious injury may require air/helicopter transport to a hospital on the main island of Puerto Rico. Additional information relating to evacuation of personnel to medical facilities on the main island is included in subsequent sections of the Emergency Management Plan.

Any diver related injuries will first be addressed immediately on-site by First Aid/CPR qualified personnel. As required, injured divers that cannot perform physical functions will be extracted from the water by the safest means possible onto the dive platform. This procedure may range from placement of the injured diver onto a floating backboard, or hand lifting the diver from the water onto the stern dive platform.

Once onboard, the DS will direct the commencement of immediate medical treatment, and assign specific tasks to individual team members as applicable.

3.2 Injuries Requiring Recompression Treatment

In the event a diver suffers an injury requiring recompression treatment, the injured diver may require air/helicopter transport to the recompression facility located at the Centro Medical Hospital on the main island of Puerto Rico.

For these cases, the DS will complete the following procedures:

- Immediately place the individual on Emergency Oxygen supply
- Contact local medical responders/ambulance for any required support
- Contact the U.S. Coast Guard (USCG) and request immediate air evacuation of the injured personnel
- Ensure the USCG is notified of the diver related injury and the need for additional emergency oxygen
- Transport the injured diver to a location suitable for helicopter extraction, and notify the USCG of this location (name of site or latitude/longitude coordinates)
- Direct the helicopter crew to fly at an altitude of 1000-ft or less if possible to avoid further complications
- Maintain a record of the injured divers time/depth profile to be provided to the treatment facility
- Ensure the injured diver is accompanied to the treatment facility by another member of the dive team, preferably an individual that is fluent in Spanish

As indicated above, the requirement to transport divers requiring recompression treatment by aircraft entails unique planning elements. Prior to commencement of diving operations, the USA DS will identify an air extraction point that is within close proximity to the dive location. The following considerations will apply:

- While diving in the waters off Piñeros island, initial boat transport back to the main island of Puerto Rico will be required to achieve a suitable helicopter landing area (local airport, open field, etc)
- Extraction point should be an open area, free of overhead power lines that would restrict helicopter maneuverability
- Dive team will carry a handheld GPS unit in order to capture latitude/longitude coordinates of extraction point

If initial transport of injured diver to an extraction point is not possible, air extraction by lift basket from the dive platform is possible, but should be considered a last resort due to increased risk to the dive team and aircrew.

Complete records of the event will be generated, and will include the following:

- Descriptions of signs and symptoms (including depth and time of onset)
- Description and results of treatment
- Name, address, and phone number of attending physician

3.3 Emergency Contact Information

Table 2-5 lists local first responders and medical facilities, along with applicable reference sources for diver related injuries:

TABLE 2-5

Agency	Contact Information
Avenue General Valero/Pr-194, 404 Fajardo, PR 00738	(787)863-0505
US Coast Guard San Juan Sector Search and Rescue Response Center	787-289-2041 VHF Channel 16
Centro Medico, Recompression Chamber	787-777-3827/5948 Extension: 6475,6476
Fajardo Police	787-889-1737/0909
Divers Alert Network	919-684-9111
Naval Experimental Diving Unit	850-230-3100

Prior to the commencement of each work day when diving operations are planned, the USA DS will ensure that communication (phone and VHF radio) has been established with local agencies required to support an emergency medical situation, and that necessary equipment and facilities (recompression chamber, helicopter, etc) are operating and available to provide response.

Section 4

4 General References

The following are references applicable to diving operation conducted in support of the RIF. USA will comply with applicable Federal, State, and local requirements. Following all applicable requirements and regulations listed in the following publications will ensure the safety and health of onsite personnel and the local community.

4.1 U.S. Navy

U.S. Navy Diving Manual, Revision 6, 15 April 2008

4.2 US Army Corps of Engineers

US Army Corps of Engineers, Safety and Health Requirements Manual, EM-385-1-1, 15 September 2008

4.3 OSHA

OSHA 29 CFR 1910, Subpart T- Commercial Diving Operations

4.4 DOD

- DOD 6055.09-M, Ammunition and Explosive Safety Standards
- DDESB TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel

ATTACHMENT 1

USA ENVIRONMENTAL, INC.
DIVING SAFE PRACTICES MANUAL

DIVING SAFE PRACTICES MANUAL
Table of Contents

Attachments

1.1) OSHA, 29 CFR 1910, Subpart T

1.2) U.S. Navy Table of No-Decompression Limits and Repetitive Group Designation for No-Decompression Air Dives

1.3) U.S. Navy Residual Nitrogen Timetables for Repetitive Air Dives

1.4) U.S. Navy Standard Air Decompression Table

1.5) Sample Forms (Pre-dive briefs, diving log sheets, and checklists)

AIR SCUBA DIVING OPERATIONS

1 INTRODUCTION

1.1 Purpose

The purpose of this Diving Safe Practices Manual is to provide divers with standard requirements and procedures to conduct safe and effective diving operations.

USA Environmental, Inc. (USA) has developed this manual to only cover diving operation performed with standard Air Self Contained Underwater Breathing Apparatus (SCUBA) systems. Diving operations conducted with any other diver system or breathing medium (surface supplied, mixed gas, etc) will not be performed unless addressed through an expanded version of this manual.

A Dive Operations Work Plan will be developed for each project requiring diving activities. This work plan will address site specific diving conditions, and reflect required diving actions, Standard Operating Procedures, and safety and health guidance.

1.2 Scope

Air SCUBA diving operations will be conducted in accordance with all applicable regulations and governing documents, including the following:

- U.S. Navy Diving Manual, Revision 6, 15 April 2008
- US Army Corps of Engineers, Safety and Health Requirements Manual, EM-385-1-1, 15 September 2008
- OSHA 29 CFR 1910, Subpart T- Commercial Diving Operations

Changes and additions to the rules and regulations governing diving operations occur periodically. As these changes to existing rules occur, or as proposed standards are finalized, areas which are in conflict with this manual will be brought to the attention of the users and, as required, changes will be issued.

2 ASSIGNMENTS AND RESPONSIBILITIES

This section details the responsibilities of USA personnel directly involved with diving operations, as related to those operations. It does not cover general responsibilities of all USA employees, such as a safety-conscious attitude. All diving personnel should read and completely understand the duties, responsibilities and standards of their particular job.

2.1 Diving Manager

The USA Diving Manager shall have overall responsibility for the safe conduct of all diving and diving-related evolutions that are being performed. The Diving Manager will ensure that the applicable Dive Operations Work Plan and Safe Practices Manual are updated, and will verify that only qualified personal are assigned to duties involving diving operations.

2.2 Diving Supervisor

A USA Dive Supervisor (DS) will be appointed for each dive operation. An employee designated as a DS shall be identified in writing and approved by the Diving Manager. Qualifications for the DS will be at the discretion of the Dive Manager, and will be based upon demonstrated knowledge, formal training, and ability to effectively supervise the intended operation.

The DS will have sufficient knowledge and experience to supervise the operation, and will ensure that divers assigned to the job are physically and mentally capable of performing designated tasks.

The DS will be responsible to the Dive Manager for ensuring strict compliance with applicable safety parameters and policies, and will promptly report any accident, injury, or variation of policies to the Dive Manager. If assigned personnel are unable to perform an assignment for medical or other reasons, the Dive Manager will be immediately informed.

The Dive Manager may, if necessary, relieve the DS at any time if conditions exists which would impact the safety of the diving operation.

The DS will have complete authority to conduct those tasks as may be assigned. If there are any pre-existing unsafe conditions, or if unsafe conditions develop during the operation, the DS will postpone or abort the dive. Any condition which might cause postponement or cessation of a dive will be resolved prior to resumption of dive operations.

Additional requirements for individual Diving Supervisors will consist of the following:

- Have thorough knowledge in all aspects of the dive operation
- Have a complete knowledge of diving related medical procedures
- Be familiar with all regulations governing diving operations, as well as with the contents of the Dive Safe Practices Manual and site specific Dive Operations Work Plan
- Maintain a complete record of each dive and generate required reports relating to the overall operation
- Establish and maintain effective communication with the Dive Manager, local agencies, and government representatives as directed.

2.3 Divers

All Divers employed by USA will meet the following meet the following criteria:

- Have training and experience working at depths up to 100 Feet of Salt Water (FSW)
- Be trained and proficient in commercial diving operations and medical procedures, and the use of industry standard diving equipment and tools
- Have a thorough understanding of the specific Dive Operations Work Plan for the intended project site.

Diver training documentation shall be in compliance with the OSHA Diving Standards 29 CFR 1910.410 and shall show that the dive team members have successfully completed training to the appropriate level (e.g., SSA diver's certificate, surface supplied mixed-gas diver certificate).

All divers will also function as safety observers during all activities, and will maintain the authorization to direct the cessation of site operations if a safety concern is identified.

2.4 Standby Diver

Personnel fulfilling the standby diver positions will be fully qualified divers in accordance with applicable regulations. The standby diver's SCUBA equipment configuration will be the same as the in-water divers, which will enable the standby diver to descend to the equivalent diving depth.

The standby diver will remain attentive to the status of the working diver to reduce emergency reaction time, and will only be deployed after being briefed by the Diving Supervisor. The brief will include specific guidance from the DS relating to the situation being encountered.

2.5 Operational and Medical Qualifications

All diving personnel will meet the experience and qualification requirements outlined in the following guidance documents:

- US Army Corps of Engineers, Safety and Health Requirements Manual, EM-385-1-1
- OSHA 29 CFR 1910, Subpart T- Commercial Diving Operations

All diving personnel will also be medically qualified to perform diving operations, and received training/certification in CPR, first aid, and the use of any auxiliary emergency medical equipment that is present at the dive site to include, but not limited to, first aid kits, oxygen systems, and Automated External Defibrillators (if provided at the dive side).

The Diving Manager and USA Human Resource Department will ensure that all diving personnel fulfill the required qualifications, and the DS will maintain records of the applicable certifications on the dive site.

3 OPERATIONAL PLANNING

The initial phase of all diving operation is Operational Planning. Proper planning will eliminate unnecessary delays and contribute to the overall success and safety of the task. The planning can be broken down into the following components:

- Definition of task
- Collection and evaluation of data
- Establishment of requirements
- Preparation for the operation.

3.1 Definition of the Task

The initial step in the planning of any operation is the definition of the task to be accomplished. This includes an in-depth breakdown of all elements required to complete the task, the location, and the time frame in which it is to be accomplished. Once these requirements have been established, planning for their accomplishment can begin.

3.2 Collection and Evaluation of Data

Once the specific tasks are established, data regarding the project site can be collected. The extent and type of information required will be influenced by such factors as the size of the operation, location of the dive site, and the time of year dive operations will be executed.

Areas to be considered when planning an operation include government regulations affecting diving, and resources (logistical and emergency) available to support the operation. Several elements will have a continuous affect on the conduct of operations, and include meteorological conditions, oceanographic conditions, and bottom conditions.

3.2.1 Meteorological Conditions

Past meteorological conditions and long-range forecasts should be evaluated to determine the probable effect that local weather will have on diving operations. This information will allow recognition of special equipment requirements and the optimal seasonal period for diving operations.

Preparations will be made to ensure that equipment and personnel are properly prepared for anticipated weather conditions. Extremes of both cold and hot temperatures require special consideration, and personnel exposed must be provided with adequate protection from the environment.

3.2.2 Oceanographic Conditions

Oceanographic conditions should be examined in order to facilitate effective operational planning. Both standard conditions, and the extent of adverse conditions due to storms or seasonal weather patterns, should be assessed.

3.2.2.1 Sea State

Sea states at a specific dive site can be consistent in nature, or fluctuate greatly depending on the related weather conditions.

Heavy seas can result in numerous conditions that make diving hazardous, both for divers and topside personnel functioning from afloat dive platforms. While divers on the bottom are not usually affected by wave action, surge can be extremely noticeable and uncomfortable to divers entering or leaving the water.

Planned equipment and dive platforms should be capable of operating in the anticipated conditions, and allow for protection of personnel during adverse weather conditions (storms, etc).

Diving operations will be terminated when, in the opinion of the Diving Supervisor, weather conditions make diving hazardous.

3.2.2.2 Water Temperature

Water temperatures will determine the duration of dive profiles, and the associated protective clothing/thermal protection that divers will require. Few factors will more rapidly fatigue a diver than continued exposure to cold water. Even in moderately warm water (60-70 °F) heat loss to the water can bring on excessive fatigue. If the diver becomes cold, the ability to concentrate and work efficiency will be reduced.

3.2.2.3 Explosive Safety

The majority of diving operations conducted by USA will involve Munitions and Explosives of Concern (MEC) and Unexploded Ordnance (UXO) items. These items present may present an explosive hazard, and will be treated in accordance with standard safety practices and procedures reflected in the specific Diver Operations Work Plan, overall project Work Plan, and project Site Safety and Health Plan.

Unless authorized and planned, divers will not make contact with MEC/UXO items, and will be aware of the effects that currents and visibility may have in safely diving in proximity of these items.

3.2.2.4 Tides and Currents

Tidal conditions generally have little effect on diving operations except when they result in a strong current. A strong current can severely limit diving and make conditions extremely hazardous for a diver. Currents can be especially dangerous to untethered divers, or divers working around structures, MEC, or UXO items.

SCUBA dives will not be conducted in currents of 1 knot or more. If currents at the dive site are questionable or unknown, the conditions will be checked to determine if they are sufficient to affect operations.

3.2.2.5 Visibility

Visibility at the dive site should be assessed, as reduced visibility conditions can reduce the diver's effectiveness and increase the time required to accomplish a task.

If the lack of visibility is due to an absence of light (such as when diving inside structures), some visibility can be restored by the use of an underwater light. The use of a light will be determined by its overall contribution to the task and the diver's ability to handle it while working underwater.

3.2.2.6 Bottom Conditions

The bottom conditions which the diver will be working in can affect selection of procedures and equipment, and can also restrict available visibility and the diver's ability to work effectively.

Obstructions such as a wreck or large amounts of debris can cause an increased potential of a diver to become entrapped or limit the visibility of the bottom surface.

Other hazards that the diver might encounter in and around the work site must also be considered and planned for. This includes isolation of impressed current cathodic protection systems on structures or moored vessels in proximity of the diver.

3.3 Diving Asset Requirements

Once the tasks and site related data is established, the assets required to ensure a safe and effective dive operation can be determined. Major areas of consideration are types of diving and support equipment, logistical demands, and personnel requirements.

3.3.1 Diving Equipment

The water depth, in-water conditions, and tasks to be accomplished are critical factors when selecting the SCUBA diving equipment that will be utilized. The diver must be able to safely and efficiently perform the required work in the equipment selected.

3.3.2 Support Equipment

Two primary factors influencing the type of required support equipment are the diving system being used and the tasks to be accomplished. The requirements for power, water, and fuel will vary between diving systems, and provisions must be made for an adequate supply of each. The tools and equipment that allow the diver to accomplish the task will also vary, and must be planned for and supplied.

The surface support and diving platforms selected will be capable of providing required services and equipment, as well as adequate space and a firm mooring capability. These platforms will also provide personnel with adequate protection from sun expose and adverse weather conditions.

3.3.3 Logistics

Logistic requirements for each dive operation will vary with intended the task, location, and duration of operations. Planning will be focused on timely delivery of all equipment, supplies, and personnel to the dive site, and maintaining an adequate supply of required materials.

3.3.4 Personnel

An evaluation of the SCUBA system that will be utilized, the type and duration of the tasks, and the location of the dive site will establish the requirement for diving and support personnel. All personnel will be properly screened to ensure that each maintains the required qualifications and certifications.

3.4 Preparation

As the requirements for a diving operation are determined, preparations will begin to ensure that assets are mobilized in a timely manner to the required.

An additional component of the preparation phase will be arranging for a Project Operations and Safety Brief. The DS will conduct this brief with all diving and support personnel prior to commencement of the overall diving operation. This contents of this brief will consist of a review of the Diving Safe Practices Manual, the Dive Operations Work Plan, applicable medical procedures, and site specific SOPs .

4 REQUIRED EQUIPMENT FOR SCUBA OPERATIONS

At a minimum, each diver will be equipped with the following items to safely conduct an open-circuit SCUBA dive:

- Open-circuit SCUBA
- Bailout bottle with a minimum of 30 cubic feet (0.85 m3) of air and separate regulator
- Face mask
- Buoyancy compensator device
- Weight belt and weights as required
- Safety harness with a positive buckling device
- Knife
- Swim fins
- Submersible pressure gauge
- Submersible wrist watch
- Submersible depth gauge.

4.1 Cylinders

Scuba cylinders (tanks or bottles) are designed to hold high pressure compressed air. Because of the extreme stresses imposed on a cylinder at these pressures, all cylinders used in SCUBA diving must be inspected and tested periodically.

Seamless steel or aluminum cylinders which meet Department of Transportation (DOT) specifications (DOT 3AA, DOT 3AL, DOT SP6498, and DOT E6498) are approved for use. Each cylinder used must have identification symbols and test dates stamped into the shoulder.

4.2 Buoyancy Compensator Device

The buoyancy compensator device (BCD) shall be capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve.

4.3 Inspection Requirements

All SCUBA equipment should be inspected upon issue, and prior to each use in accordance with the applicable pre-dive checklist.

Open-circuit SCUBA cylinders must be visually inspected at least once every 12 months and every time water or particulate matter is suspected in the cylinder. Cylinders containing visible accumulations of corrosion must be cleaned before being placed into service. Commercially available steel and aluminum SCUBA cylinders, which meet DOT specifications, must be visually inspected at least annually and must be hydrostatically tested at least every five years.

4.4 OPTIONAL EQUIPMENT FOR SCUBA OPERATIONS

The requirements of each specific diving operation determine which items of optional diving equipment may be necessary. This section lists some of the equipment that may be used:

- Protective clothing
    - Wet suit
    - Variable volume dry suit
    - Gloves
    - Hoods
    - Boots or hard-soled shoes
- Whistle
- Slate and pencil
- Tools and light
- Tool bag
- Lines and floats
- Wrist compass
- Witness float
- Snorkel
- Chemical light and strobe light

4.4.1 Protective Clothing

Requirements for protective clothing will be assessed based on the conditions of each particular dive site. Once know, the DS will ensure that divers are outfitted with applicable protection from cold water and/or heat loss during long exposure in water of moderate temperature, from chemical or bacterial pollution in the water, and from the hazards posed by marine life and underwater obstacles. Protection can be provided by wet suits, dry suits, or coveralls.

4.4.1.1 Voice Communication System

USA will plan to utilize two-way underwater voice communication systems for all diving operations. These systems are intended to enhance the safety of diving personnel and contribute to effective communication between the diver and topside personnel.

4.4.1.2 Tending Lines and Floats

A form of lifeline will be used as required to exchange signals, keep track of the diver's location, or operate in limited visibility. There are three basic types of diving related lines: a surface tending line, a floating tending line, and the buddy line.

A surface tending line extends from the diver to the diving platform, and is managed by a designated surface tender. The hard tending line can be used when operating with a single diver, and in low visibility or high current conditions with a pair of divers.

A floating tending line extends from the diver to a suitable float on the water surface. This float can be a brightly painted piece of wood, an empty sealed plastic bottle, a life ring, or any similar visible object.
A single diver may be tended with floating line, depending on the water conditions and a safety assessment made by the Diving Supervisor. USA will only utilize this method if a voice communication systems is also used to maintain communication.

A buddy line, 6 to 10 feet long, will be used to connect diver partners at night or in limited visibility conditions.

Any line used in SCUBA operations should be strong and have neutral or slightly positive buoyancy. Suitable materials include Nylon, Dacron, and manila. All lines will be attached directly to the diver, and never to a piece of SCUBA equipment that may be ripped away or removed in an emergency.

In addition, each tethered SCUBA diver shall wear a safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver’s body while maintaining the body in a heads-up vertical position when unconscious or inert.

5 AIR SUPPLY

The air supply requirement for SCUBA diving is a function of the expected duration of the dive at a specified working depth.

The duration of the air supply is dependant on a number of factors, including the depth of the dive, the work load required for the task, and the consumption rate of each individual diver.

The DS will ensure that SCUBA cylinders have adequate pressure prior to deploying a diver, and divers will regularly monitor the submersible pressure gauge, and will terminate the dive when the prescribed air pressure limits are reached.

5.1 Compressed Air from Commercial Sources

Compressed air meeting the established standards can usually be obtained from commercial sources. Air procured from commercial sources must meet the requirements of Grade A Source I or Source II air as specified by FED SPEC BB-A1034B. The following table reflects air purity standards for commercial sources:

Diver's Compressed Air Breathing Requirements if from Commercial Source

Constituent	Specification Source 1 Source II
Oxygen (percent by volume)	20-22%
Carbon dioxide (by volume)	500 ppm(max)
Carbon monoxide (by volume)	10 ppm (max)
Total hydrocarbons [as Methane (CH4) by volume]	25 ppm (max)
Odor	Not objectionable
Oil, mist, particulates	.005 mg/I (max)
Separated Water	None
Total Water	0.02 mg/1 (max)
Halogenated Compounds (by volume): Solvents	0.2 ppm (max)
Reference: FED SPEC BB-A-1034 B	

The DS will ensure that commercial sources maintain an inspection/sampling certificate for applicable air purity standards.

6 PRE-DIVE PROCEDURES

Pre-dive procedures for SCUBA operations include equipment and diver preparation, and completion of a pre-dive inspection before the divers enter the water. Checklist reflecting pre-dive procedures will be included in the site specific Dive Operations Work Plan.

6.1 Equipment Certification, Procedures, and Inspection

Prior to any dive, all divers will carefully inspect assigned equipment for signs of deterioration, damage, or corrosion. The equipment will be tested for proper operation. Pre-dive preparation procedures must be a personal concern for each diver, as verification of equipment condition and operation is a critical safety factor.

Pre-dive inspection will follow the applicable SOP included in the site specific Dive Operations Work Plan, and will include the following inspection criteria.

6.1.1 Air Cylinders

Inspection criteria includes the following:

- Inspect air cylinder exteriors and valves for rust, cracks, dents, and any evidence of weakness
- Inspect O-ring
- If equipped, verify that the reserve mechanism is closed (lever in up position) signifying a filled cylinder ready for use
- Gauge the cylinders according to the following procedure:
  - Attach pressure gauge to O-ring seal face of the on/off valve.
  - Close gauge bleed valve and open air reserve mechanism (lever in down position). Slowly open the cylinder on/off valve, keeping a cloth over the face of the gauge.

- Read pressure gauge, and remove the cylinder from use if the pressure is not sufficient to complete the planned dive
- Close the cylinder on/off valve and open the gauge bleed valve.
- When the gauge reads zero, remove the gauge from the cylinder.

6.1.1.1 Breathing Hoses

Inspection criteria includes the following:

- Check the hoses for cracks and punctures
- Test the connections of each hose at the regulator and mouthpiece assembly by tugging on the hose
- Check the clamps for corrosion and damage.

6.1.1.2 Regulator

Inspection criteria includes the following:

- Attach regulator to the cylinder manifold, ensuring that the O-ring is properly seated
- Crack the cylinder valve open and wait until the hoses and gauges have equalized
- Next open the cylinder valve completely and then close (back off) one-quartet turn
- Check for any leaks in the regulator by listening for the sound of escaping air.

6.1.1.3 Life Preserver/Buoyancy Compensator (BC)

Inspection criteria includes the following:

- Attached the auto inflation valve to an air cylinder and check for proper operation
- Inflate the preserver and check for leaks
- If equipped, inspect the carbon dioxide cartridges to ensure they have not been used (seal intact) and are the proper size for the vest being used and for the depth of dive
- Check all straps and connections for must wear and ensure secure operation.

6.1.1.4 Face Mask

Inspection criteria includes the following:

- Check the seal of the mask and the condition of the head strap
- Check for cracks in the skirt and faceplate.

6.1.1.5 Swim Fins

Inspection criteria includes the following:

- Check straps for signs of cracking
- Inspect blades for signs of cracking.

6.1.1.6 Dive Knife

Inspection criteria includes the following:

- Test the edge of the knife for sharpness
- Ensure the knife is fastened securely in the scabbard
- Verify that the knife can be removed from the scabbard without difficulty.

6.1.1.7 Depth Gauge and Compass

Inspection criteria includes the following:

- Inspect pins and straps
- If possible, check compass with another compass
- Make comparative checks on depth gauges to ensure depth gauges read zero feet of salt water (FSW) on the surface.

6.1.1.8 Miscellaneous Equipment

Inspect any other equipment that will be used on the dive, as well as any spare equipment that may be needed during the dive, including spare regulators cylinders, and gauges.

6.1.2 Predive Brief

The DS will conduct a predive brief prior to the commencement of each diving evolution in accordance with the applicable SOP contained in the site specific Dive Operations Work Plan.

6.1.3 Predive Inspection

Each diver will report for a final inspection prior to entering the water.

The DS will conduct the inspection, and ensure that the divers are physically and mentally ready to enter the water, verify the operation and configuration of all required equipment, and conduct a brief final review of the dive plan.

6.2 WATER ENTRY AND DESCENT

Once divers are ready for deployment, divers will follow procedures to ensure safe entry into the water and descent through the water column.

6.2.1 Water Entry

Water entry techniques will be determined by the nature of the diving platform. Several basic rules applicable to all methods of entry consist of the following:

- Look before jumping or pushing off from the platform or ladder
- Tuck chin into chest and hold the cylinders with one hand to prevent the manifold from hitting the back of the head
- Hold the mask in place with the fingers and the mouthpiece in place with the heel of the hand.

6.2.2 Pre-descent Surface Check

Once in the water, and before descending to operating depth, the diver will complete a final equipment check:

- Make a breathing check of the SCUBA system
- Visually check dive partner's equipment for leaks, especially at all connection points (i.e., cylinder valve, hoses at regulator and mouthpiece)
- Check partner for loose or entangled straps
- Check buoyancy and the ability to descend with the amount of weight carried on the diver.

When satisfied that all equipment is operating and functional, the divers will report readiness to the Diving Supervisor. The Diving Supervisor will direct the diver to descend and commence the dive.

6.2.3 Descent

The rate of descent will generally be governed by the ease with which the divers will be able to equalize the pressure of the inner ear and sinuses. However, the rate of descent should never exceed 75 feet per minute.

If a diver experiences difficulty in clearing, the diver must stop and ascend until the situation is resolved. If the problem persists after several attempts to equalize, the dive shall be aborted and the diver will return to the surface.

Upon reaching the operating depth, the diver will orient themselves to the surroundings, verify the site, and check the underwater conditions. If conditions appear to be radically different from those anticipated and seem to pose a hazard, the dive should be aborted and the conditions reported to the Diving Supervisor.

6.3 UNDERWATER PROCEDURES

For each SCUBA dive, bottom time is at a premium because of a limited supply of air. Divers must pace their work, conserve their energy, and address each task or issue in an effective manner.

At the same time, divers must be flexible to contend with unanticipated underwater conditions and events. Divers will terminate a dive at any time they feel that they can no longer progress toward the completion of their mission, or when conditions are judged unsafe. Divers must be alert for trouble at all times and monitor the condition of the dive partner regularly.

6.3.1 Breathing Technique

Some divers may attempt to conserve air by conducting irregular breathing patterns. One common technique is to skip-breathe, a process where a diver will insert an unnatural, long pause between each breath.

WARNING: Skip-breathing may lead to hypercapnia and shall not be practiced at any time by USA divers.

When equipped with a submersible bottle gauge, the diver shall monitor the air supply pressure and will terminate the dive whenever bottle pressure is reduced to 500 psi for a single bottle, or 250 psi for a set of double bottles.

6.3.2 Diver Communication

Diver communication is essential for conducting effective and safe diving operations.

Each diving operation will utilize some means of communication, which can range from voice communication systems, hand signals, slate boards, and line-pull signals.

6.3.2.1 Hand and Line-Pull Signals

Divers shall use hand signals shown in the applicable SOP contained in the Dive Operations Work Plan. Under certain conditions, special signals applicable to a specific mission may be devised and approved by the Diving Supervisor. Dive partners may need to communicate with line-pull signals on a buddy line if visibility restricts identifying hand signals.

Hand signals and line-pull signals should be delivered in a forceful, exaggerated manner so that there is no ambiguity and no doubt that a signal is being given. Every signal will be acknowledged by the individual receiving the signal (tender or dive partner).

6.3.3 Tending with a Surface or Buddy Line

When a diver is being tended by a line from the surface or a buddy line, several basic considerations apply.

- Lines should be kept free of slack
- Any signals via the line must be acknowledged immediately by returning the same signal.
- The tender should signal the diver with a single pull every 2 -3 minutes to determine that the diver is all right, with the diver returning the signal if no problems are encountered
- When utilizing a floating tending line, the diver will indicate that no problems are being encountered by executing a single pull of the tending line every 2-3 minutes
- The diver will maintain an awareness of the direction and attitude of the tending line to minimize the possibility of entanglement with an obstruction.

6.3.4 Tending with No Surface Line

If a tending is not used, a topside tender will keep track of the general location of the divers by observing the diver's air bubbles on the water surface. When tending a single diver with a floating tending line, the tender shall continually monitor the diver float to track the location of the diver and recognize line pull signals.

6.3.5 Working with Tools

Prior to use, divers will review applicable operating procedures and safety precautions related to underwater tools.

The dive and support team will also be aware of specific requirements associated with fuel or electrically powered tools. Precautions relating to spill containment and electrical safety will be taken.

NOTE When using externally powered tools with SCUBA, the diver must have voice communications with the Diving Supervisor.

The DS will ensure that tools will not adversely affect safety, and the diver will carry as few tools as possible. If a collection of tools are required, a holding bag should be used to lower the tools to the diver as needed.

6.3.6 Adapting to Underwater Conditions

Divers should be briefed on anticipated underwater conditions. However, the diver may have to employ techniques to offset the effects of certain underwater conditions.

General guidelines include the following:

- Stay 2 or 3 feet above a muddy or sediment bottom to avoid creating a cloud that will reduce visibility
- Be positioned so that the current will carry away any debris/sediment clouds
- Avoid coral or rocky bottoms which may cause cuts and abrasions
- Avoid abrupt changes of depth
- Do not make excursions away from the dive site unless the excursions have been included in the dive plan
- Be aware of unusually strong currents, particularly rip currents near a shoreline
- Swim against a current to approach a job site, which will result in a return swim with the current
- Stay clear of lines or wires that are under stress.

6.4 ASCENT PROCEDURES

Divers will communicate the intent to ascend to topside through the method of communication being utilized. The diver will then commence a controlled ascent to the surface, and will not exceed an ascent rate of 30 feet per minute.

The diver will breathe steadily and naturally, and must never hold their breath during ascent which can create the potential of developing an air embolism. While ascending, divers will keep an arm extended overhead to protect from contact with any obstructions.

Once on the surface, the diver will signal the DS that the diver is either “OK” or is experiencing problems and requires assistance. The diver will also report the maximum depth achieved and bottom time.

6.4.1 Emergency Free-Ascent Procedures

In the event where a diver is required to perform an emergency free ascent to the surface, the procedures listed under the General Safety section of this manual will be followed.

6.5 POSTDIVE PROCEDURES

The diver will be removed from the water as soon as possible and situated in a secure location on the dive platform or land based dive side. The DS will assess the physical condition of each diver, and conduct a debrief while the experience of the dive is still recent.

The debrief will determine if the assigned tasks were completed, if any problems were encountered, if any changes to the overall dive plan are indicated, and if the diver has any suggestions to improve the next evolution.

Each diver is responsible for the immediate post-dive maintenance and proper disposition of the equipment used during the dive.

6.6 Administrative Record Keeping

A profile of every dive will be maintained at the dive site, and dive records will contain the following information:

- Purpose of the dive
- Date, time, and location of the dive
- Name of the DS, divers, and standby divers
- Breathing media an equipment used
- Time left surface
- Time reached bottom
- Time left bottom
- Time reached surface
- Total bottom time
- Total decompression time
- Total time of dive
- Maximum depth
- Surface interval between dives
- Divers' condition
- Underwater and surface conditions
- Repetitive dive group
- General description of work performed and other remarks

Samples of the administrative record documents that will be utilized for diving operations are attached to this manual.

All diving records will be organized and maintained by the DS, and forwarded to the USA Corporate Office at the conclusion of diving operations for submission to the USACE DDC, incorporation into operational reports, and long term storage.

7 GENERAL DIVING SAFETY

Safety of all diving and support personnel is essential to the achievement of project related objectives, and will be a priority during the planning and operational phases of the overall diving program.

Safety equipment will be maintained at each dive side, and will include the following minimum equipment:

- First-aid kit meeting the requirements of Section 3, OSHA 29 CFR
- Oxygen resuscitation system capable of delivering oxygen for a minimum of 30 minutes or until emergency medical assistance can be administered
- Stokes litter or backboard, with flotation capability.

Each project dive site will present unique diving related safety concerns that must be addressed in the site specific Dive Operations Work Plan and the associated Activity Hazard Analysis (AHA) documents. However, the following is a listing of general diving emergency situations, and the corresponding actions required for an effective and timely response.

7.1 Entrapped Diver

- Diver should not panic
- Diver will evaluate the situation and determine what actions are required to gain freedom of movement
- Diver will Notify topside of the situation through available means of communication (line pull signals or voice communication).
- The diver will attempt to free himself/herself. This includes, if necessary, temporarily removing your tanks to free them. Do not immediately ditch equipment and ascend to the surface.
- If the diver is unable to become free, obtain assistance from the buddy diver, or signal the surface using line-pull signals indicating that assistance is required
- Standby diver will be deployed after being briefed by the Diving Supervisor. The standby diver will descend to the location of the entrapped diver, note the entrapped diver's air supply level, and assess the situation to determine what actions are required to free the diver.
- Once free, continue the dive or return to the surface, as appropriate
- If SCUBA equipment cannot be freed after all reasonable efforts have been made, the diver will remove the fouled equipment, ensure he/she is clear of all equipment, and execute an emergency ascent to the surface.

7.2 Actions Upon Loss of Vital Support Equipment

- DS will assess the impact of the equipment loss in regards to conduct of safe diving operations
- Topside will communicate the loss to any in water divers regarding impact to operations. Communication will be achieved through use of voice activated systems or deployment of standby diver.
- As required, abort diving operations and ensure the safety of surfacing divers is not adversely affected by equipment loss.

7.3 Actions Upon Loss of Gas Supply

- Diver should not panic
- Transition to breathing from the diver bailout bottle and immediately terminate dive with a controlled ascent to the surface
- If bailout bottle cannot be reached due to entanglement, and a buddy diver is available, commence buddy-breathing. Immediately terminate dive and commence a controlled ascent to the surface.
- If no buddy diver is available, and bailout bottle cannot be reached, diver will drop weight belt and commence an emergency ascent to the surface. Diver will not ditch SCUBA gear unless it is fouled.

- If necessary, the diver will inflate his/her flotation device/BC. Once inflated, a controlled emergency ascent might become an uncontrolled emergency ascent due to the added buoyancy
- Diver will ascend to the surface, exhaling continuously during the ascent
- Upon reaching the surface, inform the Diving Supervisor of the situation

7.4 Action Upon Loss of Communication

- Diver should not panic
- Transition to breathing from the diver bailout bottle, and immediately terminate dive with a controlled ascent to the surface
- If bailout bottle cannot be reached due to entanglement, and a buddy diver is available, commence buddy-breathing. Immediately terminate dive and perform a controlled ascent to the surface.
- If no buddy diver is available, and bailout bottle cannot be reached, diver will drop weight belt and commence an emergency ascent to the surface. Diver will not ditch SCUBA gear unless it is fouled.
- If necessary, the diver will inflate his/her flotation device/BC. Once inflated, a controlled emergency ascent might become an uncontrolled emergency ascent due to the added buoyancy
- Diver will ascend to the surface, exhaling continuously during the ascent

7.5 Lost Diver Plan

Procedures for Dive Pair

- Diver should not panic
- Complete a 360 degree search for lost diver
- If voice communication with topside is available, communicate the situation to the DS
- Note depth, time, and general location of lost diver situation
- Terminate dive and perform a controlled ascent to the surface
- During ascent, complete 360 degree searches throughout the water column
- Upon reaching the surface, inform the DS of the situation and relay information regarding depth and time of lost diver event.

Procedures for Topside Personnel

- DS will direct that a lost diver buoy is deployed overboard, and that the latitude and longitude coordinates of the site is recorded

- The DS will direct that all means to communicate with the diver are attempted (voice, line pull, and "revving" of the dive platforms engines in order to indicate that the dive is terminated and the diver should surface

- The DS will brief and deploy the standby diver to commence a search for the lost diver

- If required, additional divers will be deployed and systematic search patters will be established to extend the search area

- As required, the DS will request additional support from local agencies and the U.S. Coast Guard

7.6 Injured Diver Plan

- If diving in pairs, injured diver will be assisted in ascending to the surface. If a single diver is injured, diver will ascend to the surface or be assisted by the standby diver

- Injured diver will be removed from the water by the safest means available, and placed in a secure location on the dive platform or on land

- DS will assess the injury, and direct other personnel to perform immediate medical response actions

- As required, local medical responders will be requested at the site, or actions for evacuation of the diver will be enacted

- Dive team will refer to the site specific Dive Operations Work Plan for medical response and evacuation actions for the local area and intended diving operation

7.7 Discovery of Fire

- Personnel will immediately enact fire-fighting actions

- If divers are in the water, DS will assess if directing the divers to the surface will place them in danger, or if it is safer for divers to remain in the water during fire-fighting actions

- If operating from waterborne dive platform, Boat Captain will direct fire-fighting effort and commence emergency communication procedures as required

- Once fire-fighting efforts are complete, all dive operations will be terminated until the proper operations of all associated equipment can be verified, and confirmation is achieved that a re-flash of the fire will not occur.

7.8 Diver Blow Up/Over Rapid Ascent to Surface

- Diver will ascend to the surface, exhaling continuously during the ascent

- Upon reaching the surface, the diver will inflate his/her flotation device/BC and inform the DS of the situation

- Diver will be removed from the water and placed in a secure location on the dive platform or land

- A neurological exam will be administered to establish a baseline condition, and the diver will be and observed for a minimum of one hour to detect any developing neurological deficiencies

- Diving operations will be aborted until the DS determines that the diver did not sustain any injuries.

7.9 Diver Loss of Consciousness

Procedures for Dive Pair

- Divers should not panic

- Unaffected diver will provide immediate aid to unconscious diver, and place the mouthpiece back into the divers mouth if it has fallen out

- If voice communication with topside is available, the situation will be communicated to the DS

- The unaffected diver will take position behind the unconscious diver and establish positive control of the divers body

- The unconscious diver will be placed in an upright position, and the unaffected diver will prepare to leave the bottom

- The unaffected diver will terminate the dive and perform a controlled ascent to the surface. Positive pressure will be applied to the unconscious divers abdomen during ascent

- Upon reaching the surface, the unaffected diver will inflate the unconscious divers BC, and assist in removing the diver from the water

Procedures for Topside Personnel

- The DS will brief and deploy the standby diver to retrieve the unconscious diver

- Once located, the standby diver will perform the procedures indicated in the previous section to bring the unconscious diver to the surface and assist in removing the diver from the water

- The injured diver will be removed from the water by the safest means available, and placed in a secure location on the dive platform or on land

- DS will assess the injury, and direct other personnel to perform immediate medical response actions

- As required, local medical responders will be requested at the site, or actions for evacuation of the diver will be enacted

- The diver’s SCUBA equipment will be segregated from all other equipment

- Dive team will refer to the site specific Dive Operations Work Plan for medical response and evacuation actions for the local area and intended diving operation

- Diving operations will be secured until the cause of the unconscious diver can be determined, or until the quality of the divers air supply can be ruled out as the cause of the casualty.

7.10 Injury/illness of Member of Surface Crew with Diver in the Water

- DS will assess the injury, and direct other personnel to perform immediate medical response actions
- Dive operations will be terminated and divers will be directed to surface
- As required, local medical responders will be requested at the site, or actions for evacuation of the injured personnel will be enacted
- Dive team will refer to the site specific Dive Operations Work Plan for medical response and evacuation actions for the local area and intended diving operation
- The DS will determine when diving operations can re-commence

7.11 Adverse Weather Conditions

- DS will terminate dive operations as required
- If conducting diving operations from a waterborne platform, the DS and Boat Captain will assess whether the dive platform should return to the originating port, or if temporary shelter should be sought at a location in close proximity to the dive site
- For lightening conditions, all personnel will seek as much shelter as possible within the dive platform or land based vehicles/structures
- The DS will determine when weather conditions will safely allow diving operations to re-commence.

8 Internal Safety Inspections

The DS or assigned UXO Safety Specialist will conduct daily safety inspections of site operations, equipment condition, and personnel adherence to safety standards.

Results of the inspection will be recorded on the attached form, and maintained in the project file.

DIVING SAFE PRACTICES MANUAL

ATTACHMENT 1.1

OSHA, 29 CFR 1910, SUBPART T

OSHA 29 CFR 1910, Subpart T—Commercial Diving Operations

Authority: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); Sec. 107, Contract Work Hours and Safety Standards Act (the Construction Safety Act) (40 U.S.C. 333); Sec. 41, Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); Secretary of Labor's Order No. 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 3–2000 (65 FR 50017), or 5–2002 (67 FR 65008) as applicable; 29 CFR part 1911.

Source: 42 FR 37668, July 22, 1977, unless otherwise noted.

General

§ 1910.401 Scope and application.

(a) *Scope.* (1) This subpart (standard) applies to every place of employment within the waters of the United States, or within any State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, Wake Island, Johnston Island, the Canal Zone, or within the Outer Continental Shelf lands as defined in the Outer Continental Shelf Lands Act (67 Stat. 462, 43 U.S.C. 1331), where diving and related support operations are performed.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking and longshoring. However, this standard does not apply to any diving operation:

(i) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

(ii) Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

(iii) Governed by 45 CFR part 46 (Protection of Human Subjects, U.S. Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(iv) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(A) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(B) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

(3) *Alternative requirements for recreational diving instructors and diving guides.* Employers of recreational diving instructors and diving guides are not required to comply with the decompression-chamber requirements specified by paragraphs (b)(2) and (c)(3)(iii) of §1910.423 and paragraph (b)(1) of §1910.426 when they meet all of the following conditions:

(i) The instructor or guide is engaging solely in recreational diving instruction or dive-guiding operations;

(ii) The instructor or guide is diving within the no-decompression limits in these operations;

(iii) The instructor or guide is using a nitrox breathing-gas mixture consisting of a high percentage of oxygen (more than 22% by volume) mixed with nitrogen;

(iv) The instructor or guide is using an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus (SCUBA); and

(v) The employer of the instructor or guide is complying with all requirements of Appendix C of this subpart.

(b) *Application in emergencies.* An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

(1) Notifies the Area Director, Occupational Safety and Health Administration within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

(2) Upon request from the Area Director, submits such information in writing.

(c) *Employer obligation.* The employer shall be responsible for compliance with:

(1) All provisions of this standard of general applicability; and

(2) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.
[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 58 FR 35310, June 30, 1993; 69 FR 7363, Feb. 17, 2004]

§ 1910.402 Definitions.

As used in this standard, the listed terms are defined as follows:

Acfm: Actual cubic feet per minute.

ASME Code or equivalent:
ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.

ATA: Atmosphere absolute.

Bell: An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

Bottom time: The total elasped time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.

Bursting pressure: The pressure at which a pressure containment device would fail structurally.
Cylinder: A pressure vessel for the storage of gases.

Decompression chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

Decompression sickness: A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

Decompression table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive-guiding operations means leading groups of sports divers, who use an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, to local undersea diving locations for recreational purposes.

Dive location: A surface or vessel from which a diving operation is conducted.

Dive-location reserve breathing gas: A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.

Dive team: Divers and support employees involved in a diving operation, including the designated person-in-charge.

Diver: An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Diver-carried reserve breathing gas: A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach

the surface, or another source of breathing gas, or to be reached by a standby diver.
Diving mode: A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

Fsw: Feet of seawater (or equivalent static pressure head).
Heavy gear: Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.
Hyperbaric conditions: Pressure conditions in excess of surface pressure.

Inwater stage: A suspended underwater platform which supports a diver in the water.

Liveboating: The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

Mixed-gas diving: A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No-decompression limits: The depth-time limits of the “no-decompression limits and repetitive dive group designation table for no-decompression air dives”, U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

Psi(g): Pounds per square inch (gauge).

Recreational diving instruction means training diving students in the use of recreational diving procedures and the safe operation of diving equipment, including an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, during dives.

Scientific diving means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

SCUBA diving: A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Standby diver: A diver at the dive location available to assist a diver in the water.

Surface-supplied air diving: A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

Treatment table: A depth-time and breathing gas profile designed to treat decompression sickness.

Umbilical: The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

Volume tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 69 FR 7363, Feb. 17, 2004]

Personnel Requirements
§ 1910.410 Qualifications of dive team.

(a) *General.*

(1) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(2) Each dive team member shall have experience or training in the following:

(i) The use of tools, equipment and systems relevant to assigned tasks;

(ii) Techniques of the assigned diving mode: and

(iii) Diving operations and emergency procedures.

(3) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

(4) Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

(b) *Assignments.* (1) Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

(2) The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

(3) The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.

(c) *Designated person-in-charge.* (1) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

(2) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

General Operations Procedures
§ 1910.420   Safe practices manual.

(a) *General.* The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(b) *Contents.*

(1) The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

(2) For each diving mode engaged in, the safe practices manual shall include:

(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.
[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

§ 1910.421 Pre-dive procedures.

(a) *General.* The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(b) *Emergency aid.* A list shall be kept at the dive location of the telephone or call numbers of the following:

(1) An operational decompression chamber (if not at the dive location);

(2) Accessible hospitals;

(3) Available physicians;

(4) Available means of transportation; and

(5) The nearest U.S. Coast Guard Rescue Coordination Center.

(c) *First aid supplies.* (1) A first aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(2) When used in a decompression chamber or bell, the first aid kit shall be suitable for use under hyperbaric conditions.

(3) In addition to any other first aid supplies, an American Red Cross standard first aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location.

(d) *Planning and assessment.* Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

(1) Diving mode;
(2) Surface and underwater conditions and hazards;
(3) Breathing gas supply (including reserves);
(4) Thermal protection;
(5) Diving equipment and systems;
(6) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);
(7) Repetitive dive designation or residual inert gas status of dive team members;
(8) Decompression and treatment procedures (including altitude corrections); and
(9) Emergency procedures.

(e) *Hazardous activities.* To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

(f) *Employee briefing.* (1) Dive team members shall be briefed on:

(i) The tasks to be undertaken;

(ii) Safety procedures for the diving mode;

(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iv) Any modifications to operating procedures necessitated by the specific diving operation.

(2) Prior to making individual dive team member assignments, the employer shall inquire into the dive team

member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(g) *Equipment inspection.* The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(h) *Warning signal.* When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag “A” at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.
[42 FR 37668, July 22, 1977, as amended at 47 FR 14706, Apr. 6, 1982; 54 FR 24334, June 7, 1989]

§ 1910.422 Procedures during dive.

(a) *General.* The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(b) *Water entry and exit.* (1) A means capable of supporting the diver shall be provided for entering and exiting the water.

(2) The means provided for exiting the water shall extend below the water surface.

(3) A means shall be provided to assist an injured diver from the water or into a bell.

(c) *Communications.* (1) An operational two-way voice communication system shall be used between:

(i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and

(ii) The bell and the dive location.

(2) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

(d) *Decompression tables.* Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.

(e) *Dive profiles.* A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.

(f) *Hand-held power tools and equipment.* (1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.

(2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

(g) *Welding and burning.* (1) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:

(i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and

(ii) Kept in the open position except when the diver is welding or burning.

(2) The welding machine frame shall be grounded.

(3) Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

(4) Insulated gloves shall be provided to divers performing welding and burning operations.

(5) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gases which will not support combustion.

(h) *Explosives.* (1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of §1910.109 and §1926.912 of Title 29 of the Code of Federal Regulations.

(2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

(3) Explosives shall not be detonated while the diver is in the water.

(i) *Termination of dive.* The working interval of a dive shall be terminated when:

(1) A diver requests termination;

(2) A diver fails to respond correctly to communications or signals from a dive team member;

(3) Communications are lost and can not be quickly re-established between the diver and a dive team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or

(4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

§ 1910.423   Post-dive procedures.

(a) *General.* The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(b) *Precautions.* (1) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(2) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the diver to remain

awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(c) *Recompression capability.* (1) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(2) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(3) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within 5 minutes of the dive location.

(4) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(6) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(d) *Record of dive.* (1) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and
(vi) Maximum depth and bottom time for each diver.

(2) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification); and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(3) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

(i) Description of decompression sickness symptoms (including depth and time of onset); and

(ii) Description and results of treatment.

(e) *Decompression procedure assessment.* The employer shall:

(1) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.
[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

Specific Operations Procedures
§ 1910.424   SCUBA diving.

(a) *General.* Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* SCUBA diving shall not be conducted:

(1) At depths deeper than 130 fsw;

(2) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(3) Against currents exceeding one (1) knot unless line-tended; or

(4) In enclosed or physically confining spaces unless line-tended.

(c) *Procedures.* (1) A standby diver shall be available while a diver is in the water.

(2) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(5) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

§ 1910.425 Surface-supplied air diving.

(a) *General.* Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* (1) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

(2) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(3) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(c) *Procedures.* (1) Each diver shall be continuously tended while in the water.

(2) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(3) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(4) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(5) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An inwater stage shall be provided to divers in the water.

(6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

§ 1910.426 Mixed-gas diving.

(a) *General.* Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* Mixed-gas diving shall be conducted only when:

(1) A decompression chamber is ready for use at the dive location; and

(i) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(ii) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(c) *Procedures.*
(1) A separate dive team member shall tend each diver in the water.

(2) A standby diver shall be available while a diver is in the water.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(5) Each diving operation shall have a dive-location reserve breathing gas supply.

(6) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An inwater stage shall be provided to divers in the water.

(7) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(8) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(9) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

§ 1910.427 Liveboating.

(a) *General.* Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(b) *Limits.* Diving operations involving liveboating shall not be conducted:

(1) With an inwater decompression time of greater than 120 minutes;

(2) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(3) Using mixed gas at depths greater than 220 fsw;

(4) In rough seas which significantly inpede diver mobility or work function; or

(5) In other than daylight hours.

(c) *Procedures.* (1) The propeller of the vessel shall be stopped before the diver enters or exits the water.

(2) A device shall be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.

(3) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.

(4) A standby diver shall be available while a diver is in the water.

(5) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.
Equipment Procedures and Requirements

§ 1910.430 Equipment.

(a) *General.* (1) All employers shall comply with the following requirements, unless otherwise specified.

(2) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(b) *Air compressor system.* (1) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

(2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants.

(3) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 20 p/m;

(ii) A level of carbon dioxide (CO_2) greater than 1,000 p/m;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(4) The output of air compressor systems shall be tested for air purity every 6 months by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

(c) *Breathing gas supply hoses.* (1) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to 4 times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(2) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(3) Umbilicals shall:

(i) Be marked in 10-ft. increments to 100 feet beginning at the diver's end, and in 50 ft. increments thereafter;

(ii) Be made of kink-resistant materials; and

(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(d) *Buoyancy control.* (1) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

(2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

(3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(4) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(e) *Compressed gas cylinders.* Compressed gas cylinders shall:

(1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171.

(2) Be stored in a ventilated area and protected from excessive heat;

(3) Be secured from falling; and

(4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

(f) *Decompression chambers.* (1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(2) Each decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(3) Each decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25 percent oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(g) *Gauges and timekeeping devices.* (1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(2) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges.

(3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(4) A timekeeping device shall be available at each dive location.

(h) *Masks and helmets.* (1) Surface-supplied air and mixed-gas masks and helmets shall have:

(i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(2) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(i) *Oxygen safety.* (1) Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed for oxygen service.

(2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use.

(3) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

(j) *Weights and harnesses.* (1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(2) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:

(i) A positive buckling device;

(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and

(iii) A lifting point to distribute the pull force of the line over the diver's body.
[39 FR 23502, June 27, 1974, as amended at 49 FR 18295, Apr. 30, 1984; 51 FR 33033, Sept. 18, 1986]
Recordkeeping

§ 1910.440   Recordkeeping requirements.

(a)(1) [Reserved]

(2) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(b) *Availability of records.* (1) Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

(2) Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)–(e) and (g)–(i). Safe practices manuals (§1910.420), depth-time profiles (§1910.422), recordings of dives (§1910.423), decompression procedure assessment evaluations (§1910.423), and records of hospitalizations (§1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (§1910.430) shall also be provided upon request to employees and their designated representatives.

(3) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (§1910.411)—5 years;

(ii) Safe practices manual (§1910.420)—current document only;

(iii) Depth-time profile (§1910.422)—until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording of dive (§1910.423)—1 year, except 5 years where there has been an incident of decompression sickness;
(v) Decompression procedure assessment evaluations (§1910.423)—5 years;

(vi) Equipment inspections and testing records (§1910.430)—current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (§1910.440)—5 years.

(4) After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.20(h).

(5) In the event the employer ceases to do business:

(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or

(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services.
[42 FR 37668, July 22, 1977, as amended at 45 FR 35281, May 23, 1980; 47 FR 14706, Apr. 6, 1982; 51 FR 34562, Sept. 29, 1986; 61 FR 9242, Mar. 7, 1996; 71 FR 16672, Apr. 3, 2006]

Appendix A to Subpart T to Part 1910—Examples of Conditions Which May Restrict or Limit Exposure to Hyperbaric Conditions

The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

History of seizure disorder other than early febrile convulsions.

Malignancies (active) unless treated and without recurrence for 5 yrs.

Chronic inability to equalize sinus and/or middle ear pressure.

Cystic or cavitary disease of the lungs.

Impaired organ function caused by alcohol or drug use.

Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, moodaltering drugs, or insulin).

Meniere's disease.

Hemoglobinopathies.

Obstructive or restrictive lung disease.

Vestibular end organ destruction.

Pneumothorax.

Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).

Juxta-articular osteonecrosis.

Appendix B to Subpart T to Part 1910—Guidelines for Scientific Diving

This appendix contains guidelines that will be used in conjunction with §1910.401(a)(2)(iv) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations.

2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.

3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks

traditionally associated with commercial diving are not included within scientific diving.

4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.
[50 FR 1050, Jan. 9, 1985]

Appendix C to Subpart T to Part 1910—Alternative Conditions Under §1910.401(a)(3) for Recreational Diving Instructors and Diving Guides (Mandatory)

Paragraph (a)(3) of §1910.401 specifies that an employer of recreational diving instructors and diving guides (hereafter, "divers" or "employees") who complies with all of the conditions of this appendix need not provide a decompression chamber for these divers as required under §§1910.423(b)(2) or (c)(3) or 1910.426(b)(1).

1. Equipment Requirements for Rebreathers

(a) The employer must ensure that each employee operates the rebreather (*i.e.,* semi-closed-circuit and closed-circuit self-contained underwater breathing apparatuses (hereafter, "SCUBAs")) according to the rebreather manufacturer's instructions.

(b) The employer must ensure that each rebreather has a counterlung that supplies a sufficient volume of breathing gas to their divers to sustain the divers' respiration rates, and contains a baffle system and/or other moisture separating system that keeps moisture from entering the scrubber.

(c) The employer must place a moisture trap in the breathing loop of the rebreather, and ensure that:

(i) The rebreather manufacturer approves both the moisture trap and its location in the breathing loop; and

(ii) Each employee uses the moisture trap according to the rebreather manufacturer's instructions.

(d) The employer must ensure that each rebreather has a continuously functioning moisture sensor, and that:

(i) The moisture sensor connects to a visual (*e.g.,* digital, graphic, analog) or auditory (*e.g.,* voice, pure tone) alarm that is readily detectable by the diver under the diving conditions in which the diver operates, and warns the diver of moisture in the breathing loop in sufficient time to terminate the dive and return safely to the surface; and

(ii) Each diver uses the moisture sensor according to the rebreather manufacturer's instructions.

(e) The employer must ensure that each rebreather contains a continuously functioning CO_2sensor in the breathing loop, and that:

(i) The rebreather manufacturer approves the location of the CO_2sensor in the breathing loop;

(ii) The CO_2sensor is integrated with an alarm that operates in a visual (*e.g.,* digital, graphic, analog) or auditory (*e.g.,* voice, pure tone) mode that is readily detectable by each diver under the diving conditions in which the diver operates; and

(iii) The CO_2alarm remains continuously activated when the inhaled CO_2level reaches and exceeds 0.005 atmospheres absolute (ATA).

(f) Before each day's diving operations, and more often when necessary, the employer must calibrate the CO_2sensor according to the sensor manufacturer's instructions, and ensure that:

(i) The equipment and procedures used to perform this calibration are accurate to within 10% of a CO_2concentration of 0.005 ATA or less;

(ii) The equipment and procedures maintain this accuracy as required by the sensor manufacturer's instructions; and

(iii) The calibration of the CO_2sensor is accurate to within 10% of a CO_2concentration of 0.005 ATA or less.

(g) The employer must replace the CO_2sensor when it fails to meet the accuracy requirements specified in paragraph 1 (f)(iii) of this appendix, and ensure that the replacement CO_2sensor meets the accuracy requirements specified in paragraph 1(f)(iii) of this appendix before placing the rebreather in operation.

(h) As an alternative to using a continuously functioning CO_2sensor, the employer may use a schedule for replacing CO_2-sorbent material provided by the rebreather manufacturer. The employer may use such a schedule only when the rebreather manufacturer has developed it according to the canister-testing protocol specified below in Condition 11, and must use the canister within the temperature range for which the manufacturer conducted its scrubber canister tests following that protocol. Variations above or below the range are acceptable only after the manufacturer adds that lower or higher temperature to the protocol.

(i) When using CO_2-sorbent replacement schedules, the employer must ensure that each rebreather uses a manufactured (*i.e.,* commercially pre-packed), disposable scrubber cartridge containing a CO_2-sorbent material that:

(i) Is approved by the rebreather manufacturer;

(ii) Removes $CO_2$from the diver's exhaled gas; and

(iii) Maintains the CO_2level in the breathable gas (*i.e.,* the gas that a diver inhales directly from the regulator) below a partial pressure of 0.01 ATA.

(j) As an alternative to manufactured, disposable scrubber cartridges, the employer may fill CO_2scrubber cartridges manually with CO_2-sorbent material when:

(i) The rebreather manufacturer permits manual filling of scrubber cartridges;

(ii) The employer fills the scrubber cartridges according to the rebreather manufacturer's instructions;

(iii) The employer replaces the CO_2-sorbent material using a replacement schedule developed under paragraph 1(h) of this appendix; and

(iv) The employer demonstrates that manual filling meets the requirements specified in paragraph 1(i) of this appendix.

(k) The employer must ensure that each rebreather has an information module that provides:

(i) A visual (*e.g.,* digital, graphic, analog) or auditory (*e.g.,* voice, pure tone) display that effectively warns the diver of solenoid failure (when the rebreather uses solenoids) and other electrical weaknesses or failures (*e.g.,* low battery voltage);

(ii) For a semi-closed circuit rebreather, a visual display for the partial pressure of CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA; and

(iii) For a closed-circuit rebreather, a visual display for: partial pressures of O_2 and CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA and a preset O_2 partial pressure of 1.40 ATA or lower; gas temperature in the breathing loop; and water temperature.

(l) Before each day's diving operations, and more often when necessary, the employer must ensure that the electrical power supply and electrical and electronic circuits in each rebreather are operating as required by the rebreather manufacturer's instructions.

2. Special Requirements for Closed-Circuit Rebreathers

(a) The employer must ensure that each closed-circuit rebreather uses supply-pressure sensors for the O_2 and diluent (*i.e.,* air or nitrogen) gases and continuously functioning sensors for detecting temperature in the inhalation side of the gas-loop and the ambient water.

(b) The employer must ensure that:

(i) At least two O_2 sensors are located in the inhalation side of the breathing loop; and

(ii) The O_2 sensors are: functioning continuously; temperature compensated; and approved by the rebreather manufacturer.

(c) Before each day's diving operations, and more often when necessary, the employer must calibrate O_2 sensors as required by the sensor manufacturer's instructions. In doing so, the employer must:

(i) Ensure that the equipment and procedures used to perform the calibration are accurate to within 1% of the O_2 fraction by volume;

(ii) Maintain this accuracy as required by the manufacturer of the calibration equipment;

(iii) Ensure that the sensors are accurate to within 1% of the O_2 fraction by volume;

(iv) Replace O_2 sensors when they fail to meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix; and

(v) Ensure that the replacement O_2 sensors meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix before placing a rebreather in operation.

(d) The employer must ensure that each closed-circuit rebreather has:

(i) A gas-controller package with electrically operated solenoid O_2-supply valves;

(ii) A pressure-activated regulator with a second-stage diluent-gas addition valve;

(iii) A manually operated gas-supply bypass valve to add O_2 or diluent gas to the breathing loop; and

(iv) Separate O_2 and diluent-gas cylinders to supply the breathing-gas mixture.

3. O_2 Concentration in the Breathing Gas

The employer must ensure that the fraction of O_2 in the nitrox breathing-gas mixture:

(a) Is greater than the fraction of O_2 in compressed air (*i.e.,* exceeds 22% by volume);

(b) For open-circuit SCUBA, never exceeds a maximum fraction of breathable O_2 of 40% by volume or a maximum O_2 partial pressure of 1.40 ATA, whichever exposes divers to less O_2; and

(c) For a rebreather, never exceeds a maximum O_2 partial pressure of 1.40 ATA.

4. Regulating O_2 Exposures and Diving Depth

(a) Regarding O_2 exposure, the employer must:

(i) Ensure that the exposure of each diver to partial pressures of O_2 between 0.60 and 1.40 ATA does not exceed the 24-hour single-exposure time limits specified either by the 2001 National Oceanic and Atmospheric Administration Diving Manual (the “2001 NOAA Diving Manual”), or by the report entitled “Enriched Air Operations and Resource Guide” published in 1995 by the Professional Association of Diving Instructors (known commonly as the “1995 DSAT Oxygen Exposure Table”); and

(ii) Determine a diver's O_2-exposure duration using the diver's maximum O_2 exposure (partial pressure of O_2) during the dive and the total dive time (*i.e.,* from the time the diver leaves the surface until the diver returns to the surface).

(b) Regardless of the diving equipment used, the employer must ensure that no diver exceeds a depth of 130 feet of sea water (“fsw”) or a maximum O_2 partial pressure of 1.40 ATA, whichever exposes the diver to less O_2.

5. Use of No-Decompression Limits

(a) For diving conducted while using nitrox breathing-gas mixtures, the employer must ensure that each diver remains within the no-decompression limits specified for single and repetitive air diving and published in the 2001 NOAA Diving Manual or the report entitled “Development and Validation of No-Stop Decompression Procedures for Recreational Diving: The DSAT Recreational Dive Planner,” published in 1994 by Hamilton Research Ltd. (known commonly as the “1994 DSAT No-Decompression Tables”).

(b) An employer may permit a diver to use a dive-decompression computer designed to regulate decompression when the dive-decompression computer uses the no-decompression limits specified in paragraph 5(a) of this appendix, and provides output that reliably represents those limits.

6. Mixing and Analyzing the Breathing Gas
(a) The employer must ensure that:

(i) Properly trained personnel mix nitrox-breathing gases, and that nitrogen is the only inert gas used in the breathing-gas mixture; and

(ii) When mixing nitrox-breathing gases, they mix the appropriate breathing gas before delivering the mixture to the breathing-gas cylinders, using the continuous-flow or partial-pressure mixing techniques specified in the 2001 NOAA Diving Manual, or using a filter-membrane system.

(b) Before the start of each day's diving operations, the employer must determine the O_2fraction of the breathing-gas mixture using an O_2analyzer. In doing so, the employer must:

(i) Ensure that the O_2analyzer is accurate to within 1% of the O_2fraction by volume.

(ii) Maintain this accuracy as required by the manufacturer of the analyzer.

(c) When the breathing gas is a commercially supplied nitrox breathing-gas mixture, the employer must ensure that the O_2meets the medical USP specifications (Type I, Quality Verification Level A) or aviator's breathing-oxygen specifications (Type I, Quality Verification Level E) of CGA G–4.3–2000 (“Commodity Specification for Oxygen”). In addition, the commercial supplier must:

(i) Determine the O_2fraction in the breathing-gas mixture using an analytic method that is accurate to within 1% of the O_2fraction by volume;

(ii) Make this determination when the mixture is in the charged tank and after disconnecting the charged tank from the charging apparatus;

(iii) Include documentation of the O_2-analysis procedures and the O_2fraction when delivering the charged tanks to the employer.

(d) Before producing nitrox breathing-gas mixtures using a compressor in which the gas pressure in any system component exceeds 125 pounds per square inch (psi), the:

(i) Compressor manufacturer must provide the employer with documentation that the compressor is suitable for mixing high-pressure air with the highest O_2fraction used in the nitrox breathing-gas mixture when operated according to the manufacturer's operating and maintenance specifications;

(ii) Employer must comply with paragraph 6(e) of this appendix, unless the compressor is rated for O_2service and is oil-less or oil-free; and

(iii) Employer must ensure that the compressor meets the requirements specified in paragraphs (i)(1) and (i)(2) of §1910.430 whenever the highest O_2fraction used in the mixing process exceeds 40%.

(e) Before producing nitrox breathing-gas mixtures using an oil-lubricated compressor to mix high-pressure air with O_2, and regardless of the gas pressure in any system component, the:

(i) Employer must use only uncontaminated air (*i.e.,* air containing no hydrocarbon particulates) for the nitrox breathing-gas mixture;

(ii) Compressor manufacturer must provide the employer with documentation that the compressor is suitable for mixing the high-pressure air with the highest O_2fraction used in the nitrox breathing-gas mixture when operated according to the manufacturer's operating and maintenance specifications;

(iii) Employer must filter the high-pressure air to produce O_2-compatible air;

(iv) The filter-system manufacturer must provide the employer with documentation that the filter system used for this purpose is suitable for producing O_2-compatible air when operated according to the manufacturer's operating and maintenance specifications; and

(v) Employer must continuously monitor the air downstream from the filter for hydrocarbon contamination.

(f) The employer must ensure that diving equipment using nitrox breathing-gas mixtures or pure O_2under high pressure (*i.e.,* exceeding 125 psi) conforms to the O_2-service requirements specified in paragraphs (i)(1) and (i)(2) of §1910.430.

7. Emergency Egress

(a) Regardless of the type of diving equipment used by a diver (*i.e.,* open-circuit SCUBA or rebreathers), the employer must ensure that the equipment contains (or incorporates) an open-circuit emergency-egress system (a “bail-out” system) in which the second stage of the regulator connects to a separate supply of emergency breathing gas, and the emergency breathing gas consists of air or the same nitrox breathing-gas mixture used during the dive.

(b) As an alternative to the “bail-out” system specified in paragraph 7(a) of this appendix, the employer may use:

(i) For open-circuit SCUBA, an emergency-egress system as specified in §1910.424(c)(4); or

(ii) For a semi-closed-circuit and closed-circuit rebreather, a system configured so that the second stage of the regulator connects to a reserve supply of emergency breathing gas.

(c) The employer must obtain from the rebreather manufacturer sufficient information to ensure that the bail-out system performs reliably and has sufficient capacity to enable the diver to terminate the dive and return safely to the surface.

8. Treating Diving-Related Medical Emergencies

(a) Before each day's diving operations, the employer must:

(i) Verify that a hospital, qualified health-care professionals, and the nearest Coast Guard Coordination Center (or an equivalent rescue service operated by a state, county, or municipal agency) are available to treat diving-related medical emergencies;

(ii) Ensure that each dive site has a means to alert these treatment resources in a timely manner when a diving-related medical emergency occurs; and

(iii) Ensure that transportation to a suitable decompression chamber is readily available when no decompression chamber is at the dive site, and that this transportation can deliver the injured diver to the decompression chamber within four (4) hours travel time from the dive site.

(b) The employer must ensure that portable O_2equipment is available at the dive site to treat injured divers. In doing so, the employer must ensure that:

(i) The equipment delivers medical-grade O_2that meets the requirements for medical USP oxygen (Type I, Quality Verification Level A) of CGA G–4.3–2000 (“Commodity Specification for Oxygen”);

(ii) The equipment delivers this $O_2$to a transparent mask that covers the injured diver's nose and mouth; and

(iii) Sufficient $O_2$is available for administration to the injured diver from the time the employer recognizes the symptoms of a diving-related medical emergency until the injured diver reaches a decompression chamber for treatment.

(c) Before each day's diving operations, the employer must:

(i) Ensure that at least two attendants, either employees or non-employees, qualified in first-aid and administering O_2treatment, are available at the dive site to treat diving-related medical emergencies; and

(ii) Verify their qualifications for this task.

9. Diving Logs and No-Decompression Tables

(a) Before starting each day's diving operations, the employer must:

(i) Designate an employee or a non-employee to make entries in a diving log; and

(ii) Verify that this designee understands the diving and medical terminology, and proper procedures, for making correct entries in the diving log.

(b) The employer must:

(i) Ensure that the diving log conforms to the requirements specified by paragraph (d) (“Record of dive”) of §1910.423; and

(ii) Maintain a record of the dive according to §1910.440 (“Recordkeeping requirements”).

(c) The employer must ensure that a hard-copy of the no-decompression tables used for the dives (as specified in paragraph 6(a) of this appendix) is readily available at the dive site, whether or not the divers use dive-decompression computers.

10. Diver Training

The employer must ensure that each diver receives training that enables the diver to perform work safely and effectively while using open-circuit SCUBAs or rebreathers supplied with nitrox breathing-gas mixtures. Accordingly, each diver must be able to demonstrate the ability to perform critical tasks safely and effectively, including, but not limited to: recognizing the effects of breathing excessive CO_2 and O_2; taking appropriate action after detecting excessive levels of CO_2 and O_2; and properly evaluating, operating, and maintaining their diving equipment under the diving conditions they encounter.

11. Testing Protocol for Determining the CO_2 Limits of Rebreather Canisters

(a) The employer must ensure that the rebreather manufacturer has used the following procedures for determining that the CO_2-sorbent material meets the specifications of the sorbent material's manufacturer:

(i) The North Atlantic Treating Organization CO_2 absorbent-activity test;

(ii) The RoTap shaker and nested-sieves test;

(iii) The Navy Experimental Diving Unit (“NEDU”)-derived Schlegel test; and

(iv) The NEDU MeshFit software.

(b) The employer must ensure that the rebreather manufacturer has applied the following canister-testing materials, methods, procedures, and statistical analyses:

(i) Use of a nitrox breathing-gas mixture that has an O_2 fraction maintained at 0.28 (equivalent to 1.4 ATA of O_2 at

130 fsw, the maximum O_2 concentration permitted at this depth);

(ii) While operating the rebreather at a maximum depth of 130 fsw, use of a breathing machine to continuously ventilate the rebreather with breathing gas that is at 100% humidity and warmed to a temperature of 98.6 degrees F (37 degrees C) in the heating-humidification chamber;

(iii) Measurement of the O_2 concentration of the inhalation breathing gas delivered to the mouthpiece;

(iv) Testing of the canisters using the three ventilation rates listed in Table I below (with the required breathing-machine tidal volumes and frequencies, and CO_2-injection rates, provided for each ventilation rate):

Table I—Canister Testing Parameters

Ventilation rates (Lpm, ATPS[1])	**Breathing machine tidal volumes (L)**	**Breathing machine frequencies (breaths per min.)**	**CO_2 injection rates (Lpm, STPD[2])**
22.5	1.5	15	0.90
40.0	2.0	20	1.35
62.5	2.5	25	2.25

[1]ATPS means ambient temperature and pressure, saturated with water.
[2]STPD means standard temperature and pressure, dry; the standard temperature is 32 degrees F (0 degrees C).

(v) When using a work rate (*i.e.,* breathing-machine tidal volume and frequency) other than the work rates listed in the table above, addition of the appropriate combinations of ventilation rates and CO_2-injection rates;

(vi) Performance of the CO_2 injection at a constant (steady) and continuous rate during each testing trial;

(vii) Determination of canister duration using a minimum of four (4) water temperatures, including 40, 50, 70, and 90 degrees F (4.4, 10.0, 21.1, and 32.2 degrees C, respectively);

(viii) Monitoring of the breathing-gas temperature at the rebreather mouthpiece (at the “chrome T” connector), and ensuring that this temperature conforms to the temperature of a diver's exhaled breath at the water temperature and ventilation rate used during the testing trial;[1]

[1] NEDU can provide the manufacturer with information on the temperature of a diver's exhaled breath at various water temperatures and ventilation rates, as well as techniques and procedures used to maintain these temperatures during the testing trials.

(ix) Implementation of at least eight (8) testing trials for each combination of temperature and ventilation-CO_2-injection rates (for example, eight testing trials at 40 degrees F using a ventilation rate of 22.5 Lpm at a CO_2-injection rate of 0.90 Lpm);

(x) Allowing the water temperature to vary no more than ± 2.0 degrees F (± 1.0 degree C) *between* each of the eight testing trials, and no more than ± 1.0 degree F (± 0.5 degree C) *within* each testing trial;
(xi) Use of the average temperature for each set of eight testing trials in the statistical analysis of the testing-trial results, with the testing-trial results being the time taken for the inhaled breathing gas to reach 0.005 ATA of CO_2(*i.e.,* the canister-duration results);

(xii) Analysis of the canister-duration results using the repeated-measures statistics described in NEDU Report 2–99;

(xiii) Specification of the replacement schedule for the CO_2-sorbent materials in terms of the lower prediction line (or limit) of the 95% confidence interval; and

(xiv) Derivation of replacement schedules only by interpolating among, but not by extrapolating beyond, the depth, water temperatures, and exercise levels used during canister testing.
[69 FR 7363, Feb. 17, 2004]

DIVING SAFE PRACTICES MANUAL

ATTACHMENT 1.2

U.S. NAVY TABLE OF NO-DECOMPRESSION LIMITS AND REPETITIVE GROUP DESIGNATION FOR NO-DECOMPRESSION AIR DIVES

Table 9-7. No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives.

Depth (fsw)	No-Stop Limit	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
10	Unlimited	57	101	158	245	426	*										
15	Unlimited	36	60	88	121	163	217	297	449	*							
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*				
25	595	20	33	47	62	78	97	117	140	166	198	236	285	354	469	595	
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			
55	74	8	14	19	25	31	37	43	50	56	63	71	74				
60	60	7	12	17	22	28	33	39	45	51	57	60					
70	48	6	10	14	19	23	28	32	37	42	47	48					
80	39	5	9	12	16	20	24	28	32	36	39						
90	30	4	7	11	14	17	21	24	28	30							
100	25	4	6	9	12	15	18	21	25								
110	20	3	6	8	11	14	16	19	20								
120	15	3	5	7	10	12	15										
130	10	2	4	6	9	10											
140	10	2	4	6	8	10											
150	5	2	3	5													
160	5		3	5													
170	5			4	5												
180	5			4	5												
190	5			3	5												

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

DIVING SAFE PRACTICES MANUAL

ATTACHMENT 1.3

U.S. NAVY RESIDUAL NITROGEN TIMETABLES FOR REPETITIVE AIR DIVES

Table 9-8. *Residual Nitrogen Time Table for Repetitive Air Dives.*

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
A																:10 2:20 *
B															:10 1:16	1:17 3:36 *
C														:10 :55	:56 2:11	2:12 4:31 *
D													:10 :52	:53 1:47	1:48 3:03	3:04 5:23 *
E												:10 :52	:53 1:44	1:45 2:39	2:40 3:55	3:56 6:15 *
F											:10 :52	:53 1:44	1:45 2:37	2:38 3:31	3:32 4:48	4:49 7:08 *
G										:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:23	4:24 5:40	5:41 8:00 *
H									:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:16	5:17 6:32	6:33 8:52 *
I								:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:08	6:09 7:24	7:25 9:44 *
J							:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 7:00	7:01 8:16	8:17 10:36 *
K						:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:52	7:53 9:09	9:10 11:29 *
L					:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:44	8:45 10:01	10:02 12:21 *
M				:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:37	9:38 10:53	10:54 13:13 *
N			:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:29	10:30 11:45	11:46 14:05 *
O		:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:21	11:22 12:37	12:38 14:58 *
Z	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:19	11:20 12:13	12:14 13:30	13:31 15:50 *

Repetitive Group at the End of the Surface Interval

Dive Depth	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	427	246	159	101	58
15	**	**	**	**	**	**	**	**	450	298	218	164	122	89	61	37
20	**	**	**	**	**	462	331	257	206	166	134	106	83	62	44	27
25	†	†	470	354	286	237	198	167	141	118	98	79	63	48	34	21
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11
55	114	105	96	88	80	72	65	58	51	44	38	32	26	20	15	10
60	101	93	86	79	72	65	58	52	46	40	35	29	24	19	14	9
70	83	77	71	65	59	54	49	44	39	34	29	25	20	16	12	8
80	70	65	60	55	51	46	42	38	33	29	25	22	18	14	10	7
90	61	57	52	48	44	41	37	33	29	26	22	19	16	12	9	6
100	54	50	47	43	40	36	33	30	26	23	20	17	14	11	8	5
110	48	45	42	39	36	33	30	27	24	21	18	16	13	10	8	5
120	44	41	38	35	32	30	27	24	22	19	17	14	12	9	7	5
130	40	37	35	32	30	27	25	22	20	18	15	13	11	9	6	4
140	37	34	32	30	27	25	23	21	19	16	14	12	10	8	6	4
150	34	32	30	28	26	23	21	19	17	15	13	11	9	8	6	4
160	32	30	28	26	24	22	20	18	16	14	13	11	9	7	5	4
170	30	28	26	24	22	21	19	17	15	14	12	10	8	7	5	3
180	28	26	25	23	21	19	18	16	14	13	11	10	8	6	5	3
190	26	25	23	22	20	18	17	15	14	12	11	9	8	6	5	3

Residual Nitrogen Times (Minutes)

** Residual Nitrogen Time cannot be determined using this table (see paragraph 9-9.1 subparagraph 8 for instructions).

† Read vertically downward to the 30 fsw repetitive dive depth. Use the corresponding residual nitrogen times to compute the equivalent single dive time. Decompress using the 30 fsw air decompression table.

DIVING SAFE PRACTICES MANUAL

ATTACHMENT 1.4

U.S. NAVY STANDARD AIR DECOMPRESSION TABLES

Table 9-9. *Air Decompression Table.*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
30 FSW														
371	1:00	AIR									0	1:00	0	Z
		AIR/O_2									**0**	1:00		
380	0:20	AIR									5	6:00	0.5	Z
		AIR/O_2									**1**	2:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended --														
420	0:20	AIR									22	23:00	0.5	Z
		AIR/O_2									**5**	6:00		
480	0:20	AIR									42	43:00	0.5	
		AIR/O_2									**9**	10:00		
540	0:20	AIR									71	72:00	1	
		AIR/O_2									**14**	15:00		
Exceptional Exposure: In-Water Air Decompression ------------- In-Water Air/O_2 Decompression or SurDO_2 Required -----------														
600	0:20	AIR									92	93:00	1	
		AIR/O_2									**19**	20:00		
660	0:20	AIR									120	121:00	1	
		AIR/O_2									**22**	23:00		
720	0:20	AIR									158	159:00	1	
		AIR/O_2									**27**	28:00		
35 FSW														
232	1:10	AIR									0	1:10	0	Z
		AIR/O_2									**0**	1:10		
240	0:30	AIR									4	5:10	0.5	Z
		AIR/O_2									**2**	3:10		
In-Water Air/O_2 Decompression or SurDO_2 Recommended --														
270	0:30	AIR									28	29:10	0.5	Z
		AIR/O_2									**7**	8:10		
300	0:30	AIR									53	54:10	0.5	Z
		AIR/O_2									**13**	14:10		
330	0:30	AIR									71	72:10	1	Z
		AIR/O_2									**18**	19:10		
360	0:30	AIR									88	89:10	1	
		AIR/O_2									**22**	23:10		
Exceptional Exposure: In-Water Air Decompression ------------- In-Water Air/O_2 Decompression or SurDO_2 Required -----------														
420	0:30	AIR									134	135:10	1.5	
		AIR/O_2									**29**	30:10		
480	0:30	AIR									173	174:10	1.5	
		AIR/O_2									**38**	44:10		
540	0:30	AIR									228	229:10	2	
		AIR/O_2									**45**	51:10		
600	0:30	AIR									277	278:10	2	
		AIR/O_2									**53**	59:10		
660	0:30	AIR									314	315:10	2.5	
		AIR/O_2									**63**	69:10		
720	0:30	AIR									342	343:10	3	
		AIR/O_2									**71**	82:10		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
40 FSW														
163	1:20	AIR									0	1:20	0	O
		AIR/O_2									**0**	1:20		
170	0:40	AIR									6	7:20	0.5	O
		AIR/O_2									**2**	3:20		
180	0:40	AIR									14	15:20	0.5	Z
		AIR/O_2									**5**	6:20		
In-Water Air/O_2 Decompression or SurDO_2 Recommended -----														
190	0:40	AIR									21	22:20	0.5	Z
		AIR/O_2									**7**	8:20		
200	0:40	AIR									27	28:20	0.5	Z
		AIR/O_2									**9**	10:20		
210	0:40	AIR									39	40:20	0.5	Z
		AIR/O_2									**11**	12:20		
220	0:40	AIR									52	53:20	0.5	Z
		AIR/O_2									**12**	13:20		
230	0:40	AIR									64	65:20	1	Z
		AIR/O_2									**16**	17:20		
240	0:40	AIR									75	76:20	1	Z
		AIR/O_2									**19**	20:20		
Exceptional Exposure: In-Water Air Decompression ----- In-Water Air/O_2 Decompression or SurDO_2 Required -----														
270	0:40	AIR									101	102:20	1	Z
		AIR/O_2									**26**	27:20		
300	0:40	AIR									128	129:20	1.5	
		AIR/O_2									**33**	34:20		
330	0:40	AIR									160	161:20	1.5	
		AIR/O_2									**38**	44:20		
360	0:40	AIR									184	185:20	2	
		AIR/O_2									**44**	50:20		
420	0:40	AIR									248	249:20	2.5	
		AIR/O_2									**56**	62:20		
480	0:40	AIR									321	322:20	2.5	
		AIR/O_2									**68**	79:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ----- SurDO_2 Required-----														
540	0:40	AIR									372	373:20	3	
		AIR/O_2									**80**	91:20		
600	0:40	AIR									410	411:20	3.5	
		AIR/O_2									**93**	104:20		
660	0:40	AIR									439	440:20	4	
		AIR/O_2									**103**	119:20		
Exceptional Exposure: SurDO_2 -----														
720	0:40	AIR									461	462:20	4.5	
		AIR/O_2									**112**	128:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
45 FSW														
125	1:30	AIR									0	1:30	0	N
		AIR/O_2									**0**	1:30		
130	0:50	AIR									2	3:30	0.5	O
		AIR/O_2									**1**	2:30		
140	0:50	AIR									14	15:30	0.5	O
		AIR/O_2									**5**	6:30		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ---														
150	0:50	AIR									25	26:30	0.5	Z
		AIR/O_2									**8**	9:30		
160	0:50	AIR									34	35:30	0.5	Z
		AIR/O_2									**11**	12:30		
170	0:50	AIR									41	42:30	1	Z
		AIR/O_2									**14**	15:30		
180	0:50	AIR									59	60:30	1	Z
		AIR/O_2									**17**	18:30		
190	0:50	AIR									75	76:30	1	Z
		AIR/O_2									**19**	20:30		
Exceptional Exposure: In-Water Air Decompression ------------- In-Water Air/O_2 Decompression or SurDO_2 Required -----------														
200	0:50	AIR									89	90:30	1	Z
		AIR/O_2									**23**	24:30		
210	0:50	AIR									101	102:30	1	Z
		AIR/O_2									**27**	28:30		
220	0:50	AIR									112	113:30	1.5	Z
		AIR/O_2									**30**	31:30		
230	0:50	AIR									121	122:30	1.5	Z
		AIR/O_2									**33**	34:30		
240	0:50	AIR									130	131:30	1.5	Z
		AIR/O_2									**37**	43:30		
270	0:50	AIR									173	174:30	2	
		AIR/O_2									**45**	51:30		
300	0:50	AIR									206	207:30	2	
		AIR/O_2									**51**	57:30		
330	0:50	AIR									243	244:30	2.5	
		AIR/O_2									**61**	67:30		
360	0:50	AIR									288	289:30	3	
		AIR/O_2									**69**	80:30		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------- SurDO_2 Required--														
420	0:50	AIR									373	374:30	3.5	
		AIR/O_2									**84**	95:30		
480	0:50	AIR									431	432:30	4	
		AIR/O_2									**101**	117:30		
Exceptional Exposure: SurDO_2 ---														
540	0:50	AIR									473	474:30	4.5	
		AIR/O_2									**117**	133:30		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
50 FSW														
92	1:40	AIR									0	1:40	0	M
		AIR/O_2									**0**	1:40		
95	1:00	AIR									2	3:40	0.5	M
		AIR/O_2									**1**	2:40		
100	1:00	AIR									4	5:40	0.5	N
		AIR/O_2									**2**	3:40		
110	1:00	AIR									8	9:40	0.5	O
		AIR/O_2									**4**	5:40		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
120	1:00	AIR									21	22:40	0.5	O
		AIR/O_2									**7**	8:40		
130	1:00	AIR									34	35:40	0.5	Z
		AIR/O_2									**12**	13:40		
140	1:00	AIR									45	46:40	1	Z
		AIR/O_2									**16**	17:40		
150	1:00	AIR									56	57:40	1	Z
		AIR/O_2									**19**	20:40		
160	1:00	AIR									78	79:40	1	Z
		AIR/O_2									**23**	24:40		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
170	1:00	AIR									96	97:40	1	Z
		AIR/O_2									**26**	27:40		
180	1:00	AIR									111	112:40	1.5	Z
		AIR/O_2									**30**	31:40		
190	1:00	AIR									125	126:40	1.5	Z
		AIR/O_2									**35**	36:40		
200	1:00	AIR									136	137:40	1.5	Z
		AIR/O_2									**39**	45:40		
210	1:00	AIR									147	148:40	2	
		AIR/O_2									**43**	49:40		
220	1:00	AIR									166	167:40	2	
		AIR/O_2									**47**	53:40		
230	1:00	AIR									183	184:40	2	
		AIR/O_2									**50**	56:40		
240	1:00	AIR									198	199:40	2	
		AIR/O_2									**53**	59:40		
270	1:00	AIR									236	237:40	2.5	
		AIR/O_2									**62**	68:40		
300	1:00	AIR									285	286:40	3	
		AIR/O_2									**74**	85:40		
Exceptional Exposure: In-Water Air/O_2 Decompression ------------ SurDO_2 Required----------														
330	1:00	AIR									345	346:40	3.5	
		AIR/O_2									**83**	94:40		
360	1:00	AIR									393	394:40	3.5	
		AIR/O_2									**92**	103:40		
Exceptional Exposure: SurDO_2 ----------														
420	1:00	AIR									464	465:40	4.5	
		AIR/O_2									**113**	129:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
55 FSW														
74	1:50	AIR									0	1:50	0	L
		AIR/O_2									**0**	1:50		
75	1:10	AIR									1	2:50	0.5	L
		AIR/O_2									**1**	2:50		
80	1:10	AIR									4	5:50	0.5	M
		AIR/O_2									**2**	3:50		
90	1:10	AIR									10	11:50	0.5	N
		AIR/O_2									**5**	6:50		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
100	1:10	AIR									17	18:50	0.5	O
		AIR/O_2									**8**	9:50		
110	1:10	AIR									34	35:50	0.5	O
		AIR/O_2									**12**	13:50		
120	1:10	AIR									48	49:50	1	Z
		AIR/O_2									**17**	18:50		
130	1:10	AIR									59	60:50	1	Z
		AIR/O_2									**22**	23:50		
140	1:10	AIR									84	85:50	1	Z
		AIR/O_2									**26**	27:50		
Exceptional Exposure: In-Water Air Decompression ------------- In-Water Air/O_2 Decompression or SurDO_2 Required -----------														
150	1:10	AIR									105	106:50	1.5	Z
		AIR/O_2									**30**	31:50		
160	1:10	AIR									123	124:50	1.5	Z
		AIR/O_2									**34**	35:50		
170	1:10	AIR									138	139:50	1.5	Z
		AIR/O_2									**40**	46:50		
180	1:10	AIR									151	152:50	2	Z
		AIR/O_2									**45**	51:50		
190	1:10	AIR									169	170:50	2	
		AIR/O_2									**50**	56:50		
200	1:10	AIR									190	191:50	2	
		AIR/O_2									**54**	60:50		
210	1:10	AIR									208	209:50	2.5	
		AIR/O_2									**58**	64:50		
220	1:10	AIR									224	225:50	2.5	
		AIR/O_2									**62**	68:50		
230	1:10	AIR									239	240:50	2.5	
		AIR/O_2									**66**	77:50		
240	1:10	AIR									254	255:50	3	
		AIR/O_2									**69**	80:50		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------- SurDO_2 Required----------														
270	1:10	AIR									313	314:50	3.5	
		AIR/O_2									**83**	94:50		
300	1:10	AIR									380	381:50	3.5	
		AIR/O_2									**94**	105:50		
330	1:10	AIR									432	433:50	4	
		AIR/O_2									**106**	122:50		
Exceptional Exposure: SurDO_2 ----------														
360	1:10	AIR									474	475:50	4.5	
		AIR/O_2									**118**	134:50		

Table 9-9. Air Decompression Table (Continued).
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
60 FSW														
60	2:00	AIR									0	2:00	0	K
		AIR/O_2									**0**	2:00		
65	1:20	AIR									2	4:00	0.5	L
		AIR/O_2									**1**	3:00		
70	1:20	AIR									7	9:00	0.5	L
		AIR/O_2									**4**	6:00		
80	1:20	AIR									14	16:00	0.5	N
		AIR/O_2									**7**	9:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
90	1:20	AIR									23	25:00	0.5	O
		AIR/O_2									**10**	12:00		
100	1:20	AIR									42	44:00	1	Z
		AIR/O_2									**15**	17:00		
110	1:20	AIR									57	59:00	1	Z
		AIR/O_2									**21**	23:00		
120	1:20	AIR									75	77:00	1	Z
		AIR/O_2									**26**	28:00		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
130	1:20	AIR									102	104:00	1.5	Z
		AIR/O_2									**31**	33:00		
140	1:20	AIR									124	126:00	1.5	Z
		AIR/O_2									**35**	37:00		
150	1:20	AIR									143	145:00	2	Z
		AIR/O_2									**41**	48:00		
160	1:20	AIR									158	160:00	2	Z
		AIR/O_2									**48**	55:00		
170	1:20	AIR									178	180:00	2	
		AIR/O_2									**53**	60:00		
180	1:20	AIR									201	203:00	2.5	
		AIR/O_2									**59**	66:00		
190	1:20	AIR									222	224:00	2.5	
		AIR/O_2									**64**	71:00		
200	1:20	AIR									240	242:00	2.5	
		AIR/O_2									**68**	80:00		
210	1:20	AIR									256	258:00	3	
		AIR/O_2									**73**	85:00		
220	1:20	AIR									278	280:00	3	
		AIR/O_2									**77**	89:00		
Exceptional Exposure: In-Water Air/O_2 Decompression ------------ SurDO_2 Required														
230	1:20	AIR									300	302:00	3.5	
		AIR/O_2									**82**	94:00		
240	1:20	AIR									321	323:00	3.5	
		AIR/O_2									**88**	100:00		
270	1:20	AIR									398	400:00	4	
		AIR/O_2									**102**	119:00		
Exceptional Exposure: SurDO_2														
300	1:20	AIR									456	458:00	4.5	
		AIR/O_2									**115**	132:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
70 FSW														
48	2:20	AIR									0	2:20	0	K
		AIR/O_2									**0**	2:20		
50	1:40	AIR									2	4:20	0.5	K
		AIR/O_2									**1**	3:20		
55	1:40	AIR									9	11:20	0.5	L
		AIR/O_2									**5**	7:20		
60	1:40	AIR									14	16:20	0.5	M
		AIR/O_2									**8**	10:20		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
70	1:40	AIR									24	26:20	0.5	N
		AIR/O_2									**13**	15:20		
80	1:40	AIR									44	46:20	1	O
		AIR/O_2									**17**	19:20		
90	1:40	AIR									64	66:20	1	Z
		AIR/O_2									**24**	26:20		
100	1:40	AIR									88	90:20	1.5	Z
		AIR/O_2									**31**	33:20		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
110	1:40	AIR									120	122:20	1.5	Z
		AIR/O_2									**38**	45:20		
120	1:40	AIR									145	147:20	2	Z
		AIR/O_2									**44**	51:20		
130	1:40	AIR									167	169:20	2	Z
		AIR/O_2									**51**	58:20		
140	1:40	AIR									189	191:20	2.5	
		AIR/O_2									**59**	66:20		
150	1:40	AIR									219	221:20	2.5	
		AIR/O_2									**66**	78:20		
160	1:20	AIR								1	244	247:00	3	
		AIR/O_2								**1**	**72**	85:00		
Exceptional Exposure: In-Water Air/O_2 Decompression ------------ SurDO_2 Required														
170	1:20	AIR								2	265	269:00	3	
		AIR/O_2								**1**	**78**	91:00		
180	1:20	AIR								4	289	295:00	3.5	
		AIR/O_2								**2**	**83**	97:00		
190	1:20	AIR								5	316	323:00	3.5	
		AIR/O_2								**3**	**88**	103:00		
200	1:20	AIR								9	345	356:00	4	
		AIR/O_2								**5**	**93**	115:00		
210	1:20	AIR								13	378	393:00	4	
		AIR/O_2								**7**	**98**	122:00		
Exceptional Exposure: SurDO_2														
240	1:20	AIR								25	454	481:00	5	
		AIR/O_2								**13**	**110**	140:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
80 FSW														
39	2:40	AIR									0	2:40	0	J
		AIR/O_2									**0**	2:40		
40	2:00	AIR									1	3:40	0.5	J
		AIR/O_2									**1**	3:40		
45	2:00	AIR									10	12:40	0.5	K
		AIR/O_2									**5**	7:40		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
50	2:00	AIR									17	19:40	0.5	M
		AIR/O_2									**9**	11:40		
55	2:00	AIR									24	26:40	0.5	M
		AIR/O_2									**13**	15:40		
60	2:00	AIR									30	32:40	1	N
		AIR/O_2									**16**	18:40		
70	2:00	AIR									54	56:40	1	O
		AIR/O_2									**22**	24:40		
80	2:00	AIR									77	79:40	1.5	Z
		AIR/O_2									**30**	32:40		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
90	2:00	AIR									114	116:40	1.5	Z
		AIR/O_2									**39**	46:40		
100	1:40	AIR								1	147	150:20	2	Z
		AIR/O_2								**1**	**46**	54:20		
110	1:40	AIR								6	171	179:20	2	Z
		AIR/O_2								**3**	**51**	61:20		
120	1:40	AIR								10	200	212:20	2.5	
		AIR/O_2								**5**	**59**	71:20		
130	1:40	AIR								14	232	248:20	3	
		AIR/O_2								**7**	**67**	86:20		
Exceptional Exposure: In-Water Air/O_2 Decompression ------------ SurDO_2 Required----------														
140	1:40	AIR								17	258	277:20	3.5	
		AIR/O_2								**9**	**73**	94:20		
150	1:40	AIR								19	285	306:20	3.5	
		AIR/O_2								**10**	**80**	102:20		
160	1:40	AIR								21	318	341:20	4	
		AIR/O_2								**11**	**86**	114:20		
170	1:40	AIR								27	354	383:20	4	
		AIR/O_2								**14**	**90**	121:20		
Exceptional Exposure: SurDO_2 ----------														
180	1:40	AIR								33	391	426:20	4.5	
		AIR/O_2								**17**	**96**	130:20		
210	1:40	AIR								50	474	526:20	5	
		AIR/O_2								**26**	**110**	158:20		

Table 9-9. Air Decompression Table (Continued).
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
90 FSW														
30	3:00	AIR									0	3:00	0	I
		AIR/O_2									**0**	3:00		
35	2:20	AIR									4	7:00	0.5	J
		AIR/O_2									**2**	5:00		
40	2:20	AIR									14	17:00	0.5	L
		AIR/O_2									**7**	10:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ---														
45	2:20	AIR									23	26:00	0.5	M
		AIR/O_2									**12**	15:00		
50	2:20	AIR									31	34:00	1	N
		AIR/O_2									**17**	20:00		
55	2:20	AIR									39	42:00	1	O
		AIR/O_2									**21**	24:00		
60	2:20	AIR									56	59:00	1	O
		AIR/O_2									**24**	27:00		
70	2:20	AIR									83	86:00	1.5	Z
		AIR/O_2									**32**	35:00		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
80	2:00	AIR								5	125	132:40	2	Z
		AIR/O_2								**3**	**40**	50:40		
90	2:00	AIR								13	158	173:40	2	Z
		AIR/O_2								**7**	**46**	60:40		
100	2:00	AIR								19	185	206:40	2.5	
		AIR/O_2								**10**	**53**	70:40		
110	2:00	AIR								25	224	251:40	3	
		AIR/O_2								**13**	**61**	86:40		
Exceptional Exposure: In-Water Air/O_2 Decompression ------------ SurDO_2 Required--														
120	1:40	AIR							1	29	256	288:20	3.5	
		AIR/O_2							1	**15**	**70**	98:40		
130	1:40	AIR							5	28	291	326:20	3.5	
		AIR/O_2							5	**15**	**78**	110:40		
140	1:40	AIR							8	28	330	368:20	4	
		AIR/O_2							8	**15**	**86**	126:40		
Exceptional Exposure: SurDO_2 --														
150	1:40	AIR							11	34	378	425:20	4.5	
		AIR/O_2							11	**17**	**94**	139:40		
160	1:40	AIR							13	40	418	473:20	4.5	
		AIR/O_2							13	**21**	**100**	151:40		
170	1:40	AIR							15	45	451	513:20	5	
		AIR/O_2							15	**23**	**106**	166:40		
180	1:40	AIR							16	51	479	548:20	5.5	
		AIR/O_2							16	**26**	**112**	176:40		
240	1:40	AIR							42	68	592	704:20	7.5	
		AIR/O_2							42	**34**	**159**	267:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
100 FSW														
25	3:20	AIR									0	3:20	0	H
		AIR/O_2									**0**	3:20		
30	2:40	AIR									3	6:20	0.5	J
		AIR/O_2									**2**	5:20		
35	2:40	AIR									15	18:20	0.5	L
		AIR/O_2									**8**	11:20		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
40	2:40	AIR									26	29:20	1	M
		AIR/O_2									**14**	17:20		
45	2:40	AIR									36	39:20	1	N
		AIR/O_2									**19**	22:20		
50	2:40	AIR									47	50:20	1	O
		AIR/O_2									**24**	27:20		
55	2:40	AIR									65	68:20	1.5	Z
		AIR/O_2									**28**	31:20		
60	2:40	AIR									81	84:20	1.5	Z
		AIR/O_2									**33**	35:20		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
70	2:20	AIR								11	124	138:00	2	Z
		AIR/O_2								**6**	**39**	53:00		
80	2:20	AIR								21	160	184:00	2.5	Z
		AIR/O_2								**11**	**45**	64:00		
90	2:00	AIR							2	28	196	228:40	2.5	
		AIR/O_2							2	**15**	**52**	82:00		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required														
100	2:00	AIR							9	28	241	280:40	3	
		AIR/O_2							9	**14**	**66**	102:00		
110	2:00	AIR							14	28	278	322:40	3.5	
		AIR/O_2							14	**15**	**75**	117:00		
120	2:00	AIR							19	28	324	373:40	4	
		AIR/O_2							19	**15**	**84**	136:00		
Exceptional Exposure: SurDO_2														
150	1:40	AIR						3	26	46	461	538:20	5	
		AIR/O_2						3	26	**24**	**108**	183:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
110 FSW														
20	3:40	AIR									0	3:40	0	H
		AIR/O_2									**0**	3:40		
25	3:00	AIR									3	6:40	0.5	I
		AIR/O_2									**2**	5:40		
30	3:00	AIR									14	17:40	0.5	K
		AIR/O_2									**7**	10:40		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
35	3:00	AIR									27	30:40	1	M
		AIR/O_2									**14**	17:40		
40	3:00	AIR									39	42:40	1	N
		AIR/O_2									**20**	23:40		
45	3:00	AIR									50	53:40	1	O
		AIR/O_2									**26**	29:40		
50	3:00	AIR									71	74:40	1.5	Z
		AIR/O_2									**31**	34:40		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required -----------														
55	2:40	AIR								5	85	93:20	1.5	Z
		AIR/O_2								**3**	**33**	44:20		
60	2:40	AIR								13	111	127:20	2	Z
		AIR/O_2								**7**	**36**	51:20		
70	2:40	AIR								26	155	184:20	2.5	Z
		AIR/O_2								**13**	**43**	64:20		
80	2:20	AIR							9	28	200	240:00	2.5	
		AIR/O_2							9	**15**	**53**	90:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required----------														
90	2:20	AIR							17	29	248	297:00	3.5	
		AIR/O_2							17	**15**	**67**	112:20		
100	2:20	AIR							25	28	295	351:00	3.5	
		AIR/O_2							25	**15**	**78**	131:20		
110	2:00	AIR						5	26	28	353	414:40	4	
		AIR/O_2						5	26	**15**	**90**	154:00		
Exceptional Exposure: SurDO_2 ----------														
120	2:00	AIR						10	26	35	413	486:40	4.5	
		AIR/O_2						10	26	**18**	**101**	173:00		
180	1:40	AIR					3	23	47	68	593	736:20	7.5	
		AIR/O_2					3	23	47	**34**	**159**	298:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
120 FSW														
15	4:00	AIR									0	4:00	0	F
		AIR/O_2									**0**	4:00		
20	3:20	AIR									2	6:00	0.5	H
		AIR/O_2									**1**	5:00		
25	3:20	AIR									8	12:00	0.5	J
		AIR/O_2									**4**	8:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
30	3:20	AIR									24	28:00	0.5	L
		AIR/O_2									**13**	17:00		
35	3:20	AIR									38	42:00	1	N
		AIR/O_2									**20**	24:00		
40	3:20	AIR									51	55:00	1	O
		AIR/O_2									**27**	31:00		
45	3:20	AIR									72	76:00	1.5	Z
		AIR/O_2									**33**	37:00		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required -----------														
50	3:00	AIR								9	86	98:40	1.5	Z
		AIR/O_2								**5**	**33**	46:40		
55	3:00	AIR								19	116	138:40	2	Z
		AIR/O_2								**10**	**35**	53:40		
60	3:00	AIR								27	142	172:40	2	Z
		AIR/O_2								**14**	**39**	61:40		
70	2:40	AIR							12	29	189	233:20	2.5	
		AIR/O_2							12	**15**	**50**	85:40		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required----------														
80	2:40	AIR							24	28	246	301:20	3	
		AIR/O_2							24	**14**	**67**	118:40		
90	2:20	AIR						7	26	28	303	367:00	3.5	
		AIR/O_2						7	26	**15**	**79**	140:20		
100	2:20	AIR						14	26	28	372	443:00	4	
		AIR/O_2						14	26	**15**	**94**	167:20		
Exceptional Exposure: SurDO_2 ----------														
110	2:20	AIR						21	25	38	433	520:00	5	
		AIR/O_2						21	25	**20**	**104**	188:20		
120	2:00	AIR					3	23	25	47	480	580:40	5.5	
		AIR/O_2					3	23	25	**24**	**113**	211:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
130 FSW														
10	4:20	AIR									0	4:20	0	E
		AIR/O_2									**0**	4:20		
15	3:40	AIR									1	5:20	0.5	G
		AIR/O_2									**1**	5:20		
20	3:40	AIR									4	8:20	0.5	I
		AIR/O_2									**2**	6:20		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
25	3:40	AIR									17	21:20	0.5	K
		AIR/O_2									**9**	13:20		
30	3:40	AIR									34	38:20	1	M
		AIR/O_2									**18**	22:20		
35	3:40	AIR									49	53:20	1	N
		AIR/O_2									**26**	30:20		
40	3:20	AIR								3	67	74:00	1.5	Z
		AIR/O_2								**2**	**31**	37:00		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
45	3:20	AIR								12	84	100:00	1.5	Z
		AIR/O_2								**6**	**33**	48:00		
50	3:20	AIR								22	116	142:00	2	Z
		AIR/O_2								**11**	**35**	55:00		
55	3:00	AIR							4	28	145	180:40	2	Z
		AIR/O_2							4	**15**	**39**	67:00		
60	3:00	AIR							12	28	170	213:40	2.5	Z
		AIR/O_2							12	**15**	**45**	81:00		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required----------														
70	2:40	AIR						1	26	28	235	293:20	3	
		AIR/O_2						1	26	**14**	**63**	117:40		
80	2:40	AIR						12	26	28	297	366:20	3.5	
		AIR/O_2						12	26	**15**	**78**	144:40		
90	2:40	AIR						21	26	28	374	452:20	4	
		AIR/O_2						21	26	**15**	**94**	174:40		
Exceptional Exposure: SurDO_2 ----------														
100	2:20	AIR					6	23	26	38	444	540:00	5	
		AIR/O_2					6	23	26	**20**	**106**	204:20		
120	2:20	AIR					17	23	28	57	533	661:00	6	
		AIR/O_2					17	23	28	**29**	**130**	255:20		
180	2:00	AIR				13	21	45	57	94	658	890:40	9	
		AIR/O_2				13	21	45	57	**46**	**198**	417:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
140 FSW														
10	4:40	AIR									0	4:40	0	E
		AIR/O_2									**0**	4:40		
15	4:00	AIR									2	6:40	0.5	H
		AIR/O_2									**1**	5:40		
20	4:00	AIR									7	11:40	0.5	J
		AIR/O_2									**4**	8:40		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
25	4:00	AIR									26	30:40	1	L
		AIR/O_2									**14**	18:40		
30	4:00	AIR									44	48:40	1	N
		AIR/O_2									**23**	27:40		
35	3:40	AIR								4	59	67:20	1.5	O
		AIR/O_2								**2**	**30**	36:20		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required -----------														
40	3:40	AIR								11	80	95:20	1.5	Z
		AIR/O_2								**6**	**33**	48:20		
45	3:20	AIR							3	21	113	141:00	2	Z
		AIR/O_2							3	**11**	**34**	57:20		
50	3:20	AIR							7	28	145	184:00	2	Z
		AIR/O_2							7	**14**	**40**	70:20		
55	3:20	AIR							16	28	171	219:00	2.5	Z
		AIR/O_2							16	**15**	**45**	85:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required----------														
60	3:00	AIR						2	23	28	209	265:40	3	
		AIR/O_2						2	23	**15**	**55**	109:00		
70	3:00	AIR						14	25	28	276	346:40	3.5	
		AIR/O_2						14	25	**15**	**74**	142:00		
80	2:40	AIR					2	24	25	29	362	445:20	4	
		AIR/O_2					2	24	25	**15**	**91**	175:40		
Exceptional Exposure: SurDO_2 ----------														
90	2:40	AIR					12	23	26	38	443	545:20	5	
		AIR/O_2					12	23	26	**19**	**107**	210:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
150 FSW														
5	5:00	AIR									0	5:00	0	C
		AIR/O_2									**0**	5:00		
10	4:20	AIR									1	6:00	0.5	F
		AIR/O_2									**1**	6:00		
15	4:20	AIR									3	8:00	0.5	H
		AIR/O_2									**2**	7:00		
20	4:20	AIR									14	19:00	0.5	K
		AIR/O_2									**8**	13:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
25	4:20	AIR									35	40:00	1	M
		AIR/O_2									**19**	24:00		
30	4:00	AIR								3	51	58:40	1.5	O
		AIR/O_2								**2**	**26**	32:40		
35	4:00	AIR								11	72	87:40	1.5	Z
		AIR/O_2								**6**	**31**	46:40		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
40	3:40	AIR							4	18	102	128:20	2	Z
		AIR/O_2							4	**9**	**34**	56:40		
45	3:40	AIR							10	25	140	179:20	2	Z
		AIR/O_2							10	**13**	**39**	71:40		
50	3:20	AIR						3	15	28	170	220:00	2.5	Z
		AIR/O_2						3	15	**15**	**45**	87:20		
Exceptional Exposure: In-Water Air/O_2 Decompression ------------ SurDO_2 Required----------														
55	3:20	AIR						6	22	28	211	271:00	3	
		AIR/O_2						6	22	**15**	**56**	113:20		
60	3:20	AIR						11	26	28	248	317:00	3	
		AIR/O_2						11	26	**15**	**66**	132:20		
70	3:00	AIR					3	24	25	28	330	413:40	4	
		AIR/O_2					3	24	25	**15**	**84**	170:00		
Exceptional Exposure: SurDO_2 ----------														
80	3:00	AIR					15	23	26	35	430	532:40	4.5	
		AIR/O_2					15	23	26	**18**	**104**	205:00		
90	2:40	AIR				3	22	23	26	47	496	620:20	5.5	
		AIR/O_2				3	22	23	26	**24**	**118**	239:40		
120	2:20	AIR			3	20	22	23	50	75	608	804:00	8	
		AIR/O_2			3	20	22	23	50	**37**	**168**	355:40		
180	2:00	AIR		2	19	20	42	48	79	121	694	1027:40	10.5	
		AIR/O_2		2	19	20	42	48	79	**58**	**222**	537:20		

Table 9-9. Air Decompression Table (Continued).
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
160 FSW														
5	5:20	AIR									0	5:20	0	C
		AIR/O_2									**0**	5:20		
10	4:40	AIR									1	6:20	0.5	F
		AIR/O_2									**1**	6:20		
15	4:40	AIR									5	10:20	0.5	I
		AIR/O_2									**3**	8:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
20	4:40	AIR									22	27:20	0.5	L
		AIR/O_2									**12**	17:20		
25	4:20	AIR								3	41	49:00	1	N
		AIR/O_2								**2**	**21**	28:00		
30	4:00	AIR							1	8	60	73:40	1.5	O
		AIR/O_2							1	**5**	**28**	39:00		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
35	4:00	AIR							4	14	84	106:40	1.5	Z
		AIR/O_2							4	**8**	**32**	54:00		
40	4:00	AIR							12	20	130	166:40	2	Z
		AIR/O_2							12	**11**	**37**	70:00		
45	3:40	AIR						5	13	28	164	214:20	2.5	Z
		AIR/O_2						5	13	**14**	**44**	85:40		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required----------														
50	3:40	AIR						10	19	28	207	268:20	3	
		AIR/O_2						10	19	**15**	**54**	112:40		
55	3:20	AIR					2	12	26	28	248	320:00	3	
		AIR/O_2					2	12	26	**14**	**67**	135:20		
60	3:20	AIR					5	18	25	29	290	371:00	3.5	
		AIR/O_2					5	18	25	**15**	**77**	154:20		
Exceptional Exposure: SurDO_2 ----------														
70	3:20	AIR					15	23	26	29	399	496:00	4.5	
		AIR/O_2					15	23	26	**15**	**99**	197:20		
80	3:00	AIR				6	21	24	25	44	482	605:40	5.5	
		AIR/O_2				6	21	24	25	**23**	**114**	237.00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
170 FSW														
5	5:40	AIR									0	5:40	0	D
		AIR/O_2									**0**	5:40		
10	5:00	AIR									2	7:40	0.5	G
		AIR/O_2									**1**	6:40		
15	5:00	AIR									7	12:40	0.5	J
		AIR/O_2									**4**	9:40		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
20	4:40	AIR								1	29	35:20	1	L
		AIR/O_2								**1**	**15**	21:20		
25	4:20	AIR							1	6	46	58:00	1	N
		AIR/O_2							1	**4**	**23**	33:20		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
30	4:20	AIR							5	11	72	93:00	1.5	Z
		AIR/O_2							5	**6**	**29**	45:20		
35	4:00	AIR						2	9	17	113	145:40	2	Z
		AIR/O_2						2	9	**9**	**35**	65:00		
40	4:00	AIR						6	13	23	155	201:40	2.5	Z
		AIR/O_2						6	13	**12**	**43**	84:00		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required														
45	4:00	AIR						12	16	28	194	254:40	2.5	
		AIR/O_2						12	16	**15**	**51**	109:00		
50	3:40	AIR					5	12	23	28	243	315:20	3	
		AIR/O_2					5	12	23	**15**	**65**	134:40		
55	3:40	AIR					9	16	25	28	287	369:20	3.5	
		AIR/O_2					9	16	25	**15**	**76**	155:40		
60	3:20	AIR				2	11	21	26	28	344	436:00	4	
		AIR/O_2				2	11	21	26	**15**	**87**	181:20		
Exceptional Exposure: SurDO_2														
70	3:20	AIR				7	19	24	25	39	454	572:00	5	
		AIR/O_2				7	19	24	25	**20**	**109**	228:20		
80	3:20	AIR				17	22	23	26	53	525	670:00	6	
		AIR/O_2				17	22	23	26	**27**	**128**	267:20		
90	3:00	AIR			7	20	22	23	37	66	574	752:40	7	
		AIR/O_2			7	20	22	23	37	**33**	**148**	318:20		
120	2:40	AIR		9	19	20	22	42	60	94	659	928:20	9	
		AIR/O_2		9	19	20	22	42	60	**46**	**198**	454:00		
180	2:20	AIR	10	18	19	40	43	70	97	156	703	1159:00	11.5	
		AIR/O_2	10	18	19	40	43	70	97	**75**	**228**	648:00		

Table 9-9. Air Decompression Table (Continued).

(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
180 FSW														
5	6:00	AIR									0	6:00	0	D
		AIR/O_2									**0**	6:00		
10	5:20	AIR									3	9:00	0.5	G
		AIR/O_2									**2**	8:00		
15	5:20	AIR									11	17:00	0.5	J
		AIR/O_2									**6**	12:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
20	5:00	AIR								4	34	43:40	1	M
		AIR/O_2								**2**	**18**	25:40		
25	4:40	AIR							4	7	54	70:20	1.5	O
		AIR/O_2							4	**4**	**26**	39:40		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
30	4:20	AIR						2	7	14	83	111:00	1.5	Z
		AIR/O_2						2	7	**7**	**31**	57:20		
35	4:20	AIR						5	13	19	138	180:00	2	Z
		AIR/O_2						5	13	**10**	**40**	78:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required														
40	4:00	AIR					2	11	12	28	175	232:40	2.5	Z
		AIR/O_2					2	11	12	**14**	**47**	96:00		
45	4:00	AIR					7	11	20	28	231	301:40	3	
		AIR/O_2					7	11	20	**15**	**61**	129:00		
50	3:40	AIR				1	11	13	25	28	276	358:20	3.5	
		AIR/O_2				1	11	13	25	**15**	**74**	153:40		
55	3:40	AIR				5	11	19	26	28	336	429:20	4	
		AIR/O_2				5	11	19	26	**14**	**87**	181:40		
Exceptional Exposure: SurDO_2														
60	3:40	AIR				8	13	24	25	31	405	510:20	4.5	
		AIR/O_2				8	13	24	25	**16**	**100**	205:40		
70	3:20	AIR			3	13	21	24	25	48	498	636:00	5.5	
		AIR/O_2			3	13	21	24	25	**25**	**118**	253:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
190 FSW														
5	6:20	AIR									0	6:20	0	D
		AIR/O_2									**0**	6:20		
10	5:40	AIR									4	10:20	0.5	H
		AIR/O_2									**2**	8:20		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
15	5:40	AIR									17	23:20	0.5	K
		AIR/O_2									**9**	15:20		
20	5:00	AIR							1	7	37	50:40	1	N
		AIR/O_2							1	**4**	**19**	30:00		
25	4:40	AIR						2	6	9	67	89:20	1.5	Z
		AIR/O_2						2	6	**5**	**28**	46:40		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
30	4:40	AIR						6	8	14	111	144:20	2	Z
		AIR/O_2						6	8	**8**	**35**	67:40		
35	4:20	AIR					3	8	13	22	160	211:00	2.5	Z
		AIR/O_2					3	8	13	**12**	**44**	90:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ------------ SurDO_2 Required														
40	4:20	AIR					7	12	14	29	210	277:00	3	
		AIR/O_2					7	12	14	**15**	**56**	119:20		
45	4:00	AIR				2	11	12	23	28	262	342:40	3.5	
		AIR/O_2				2	11	12	23	**15**	**70**	148:00		
50	4:00	AIR				7	11	16	26	28	321	413:40	4	
		AIR/O_2				7	11	16	26	**15**	**83**	178:00		
Exceptional Exposure: SurDO2														
55	3:40	AIR			2	10	10	24	25	30	396	501:20	4.5	
		AIR/O_2			2	10	10	24	25	**16**	**98**	204:40		
60	3:40	AIR			5	10	16	24	25	40	454	578:20	5	
		AIR/O_2			5	10	16	24	25	**21**	**108**	233:40		
90	3:20	AIR		11	19	20	21	28	51	83	626	863:00	8.5	
		AIR/O_2		11	19	20	21	28	51	**42**	**177**	408:40		
120	3:00	AIR	15	17	19	20	37	46	79	113	691	1040:40	10.5	
		AIR/O_2	15	17	19	20	37	46	79	**55**	**219**	550:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
200 FSW														
Exceptional Exposure														
5	6:00	AIR									1	7:40	0.5	
		AIR/O_2									**1**	7:40		
10	6:00	AIR									2	8:40	0.5	
		AIR/O_2									**1**	7:40		
15	5:40	AIR								2	22	30:20	0.5	
		AIR/O_2								**1**	**11**	18:20		
20	5:20	AIR							5	6	43	60:00	1	
		AIR/O_2							5	**4**	**21**	36:20		
25	5:00	AIR						5	6	11	78	105:40	1.5	
		AIR/O_2						5	6	**6**	**29**	52:00		
30	4:40	AIR					4	5	11	18	136	179:20	2	
		AIR/O_2					4	5	11	**9**	**40**	79:40		
35	4:20	AIR				1	6	10	13	26	179	240:00	2.5	
		AIR/O_2				1	6	10	13	**13**	**49**	102:20		
40	4:20	AIR				3	10	12	18	28	243	319:00	3	
		AIR/O_2				3	10	12	18	**15**	**65**	138:20		
45	4:20	AIR				8	11	12	26	28	300	390:00	3.5	
		AIR/O_2				8	11	12	26	**15**	**79**	166:20		
50	4:00	AIR			3	10	11	20	26	28	377	479:40	4.5	
		AIR/O_2			3	10	11	20	26	**15**	**95**	200:00		
210 FSW														
Exceptional Exposure														
5	6:20	AIR									1	8:00	0.5	
		AIR/O_2									**1**	8:00		
10	6:20	AIR									5	12:00	0.5	
		AIR/O_2									**3**	10:00		
15	6:00	AIR								5	26	37:40	1	
		AIR/O_2								**3**	**13**	22:40		
20	5:20	AIR						2	6	7	50	71:00	1.5	
		AIR/O_2						2	6	**4**	**24**	42:20		
25	5:00	AIR					2	6	7	13	94	127:40	1.5	
		AIR/O_2					2	6	7	**7**	**32**	65:00		
30	4:40	AIR				2	5	6	13	21	156	208:20	2	
		AIR/O_2				2	5	6	13	**11**	**43**	90:40		
35	4:40	AIR				5	6	12	14	28	214	284:20	3	
		AIR/O_2				5	6	12	14	**14**	**58**	124:40		
40	4:20	AIR			2	6	11	12	22	28	271	357:00	3.5	
		AIR/O_2			2	6	11	12	22	**15**	**74**	157:20		
45	4:20	AIR			4	10	11	16	25	29	347	447:00	4	
		AIR/O_2			4	10	11	16	25	**15**	**89**	190:20		
50	4:20	AIR			9	10	11	23	26	35	426	545:00	4.5	
		AIR/O_2			9	10	11	23	26	**18**	**104**	221:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
220 FSW														
Exceptional Exposure														
5	6:40	AIR									2	9:20	0.5	
		AIR/O_2									**1**	8:20		
10	6:40	AIR									8	15:20	0.5	
		AIR/O_2									**4**	11:20		
15	6:00	AIR							1	7	30	44:40	1	
		AIR/O_2							1	**4**	**15**	27:00		
20	5:40	AIR						5	6	7	63	87:20	1.5	
		AIR/O_2						5	6	**4**	**27**	48:40		
25	5:20	AIR					5	6	8	14	119	158:00	2	
		AIR/O_2					5	6	8	**7**	**38**	75:20		
30	5:00	AIR				5	5	8	13	24	174	234:40	2.5	
		AIR/O_2				5	5	8	13	**13**	**47**	102:00		
35	4:40	AIR			3	5	9	11	18	28	244	323:20	3	
		AIR/O_2			3	5	9	11	18	**15**	**66**	142:40		
40	4:20	AIR		1	4	9	11	11	26	28	312	407:00	4	
		AIR/O_2		1	4	9	11	11	26	**15**	**82**	179:20		
250 FSW														
Exceptional Exposure														
5	7:40	AIR									3	11:20	0.5	
		AIR/O_2									**2**	10:20		
10	7:20	AIR								2	15	25:00	0.5	
		AIR/O_2								**1**	**8**	17:00		
15	6:40	AIR						3	7	7	41	65:20	1	
		AIR/O_2						3	7	**4**	**21**	42:40		
20	6:00	AIR				2	6	5	7	12	106	144:40	2	
		AIR/O_2				2	6	5	7	**6**	**35**	73:00		
25	5:40	AIR			4	5	5	7	13	24	175	239:20	2.5	
		AIR/O_2			4	5	5	7	13	**13**	**47**	105:40		
30	5:20	AIR		4	4	5	9	11	20	28	257	344:00	3.5	
		AIR/O_2		4	4	5	9	11	20	**14**	**70**	153:20		
35	5:00	AIR	2	5	4	10	11	14	25	29	347	452:40	4	
		AIR/O_2	2	5	4	10	11	14	25	**15**	**89**	196:00		
300 FSW														
Exceptional Exposure														
5	9:20	AIR									6	16:00	0.5	
		AIR/O_2									**3**	13:00		
10	8:20	AIR						2	5	7	32	55:00	1	
		AIR/O_2						2	5	**4**	**16**	36:20		
15	7:20	AIR			1	4	5	6	6	10	102	142:00	1.5	
		AIR/O_2			1	4	5	6	6	**5**	**35**	75:20		
20	6:40	AIR	1	4	5	5	5	6	14	28	196	271:20	2.5	
		AIR/O_2	1	4	5	5	5	6	14	**15**	**52**	124:40		
25	6:40	AIR	7	4	5	5	10	12	25	29	305	409:00	3.5	
		AIR/O_2	7	4	5	5	10	12	25	**15**	**80**	180:20		

DIVING SAFE PRACTICES MANUAL

ATTACHMENT 1.5

SAMPLE FORMS

- **Pre Dive Brief**
- **Dive Supervisor Checklist**
- **SCUBA Dive Log**

SAMPLE FORMS: SCUBA PRE DIVE BRIEF

****This pre dive brief will be conducted each work day diving operations are planned, and will be completed in concert with the other required project Safety meetings and Tailgate Safety Briefs.**

****Underwater explosive disposal events will also require completion of a task specific safety and operations brief.**

DATE ____________________

DIVE SUMMARY

Purpose of the Dive: ____

Diving System in Use: ____

Location of Dive Site: ____

Boat Platform or Land Based Dive Side ____

Special Tools/Equipment ____

DIVE PROFILE

Planned Table/Schedule: ________ FSW /__________ (min)

Repet Group: __________

Non-Decompression Limits for Anticipated dive depth: _____ (min)

Non-Decompression Limits for next deeper dive profile: ________ FSW /__________ (min)

Divers will not exceed a depth of ________(FSW) during the dive

Diver will not exceed a bottom time of _________(min) during the dive

SITE CONDITIONS

1) Water Temp ___________

2) Air Temp ___________

3) Wind Speed ____________ Direction ____________

4) Sunrise _______________ Sunset __________

5) Surface Conditions/Wave Height _____________

6) Low Tide ______________ High Tide __________

7) Anticipated Current _______ Direction _______________

8) Bottom Type ___________

9) In-Water Visibility __________

ANTICIPATED SITE HAZARDS

1) Boat Traffic

2) Weather Related Hazards

3) Unexploded Ordnance

4) Sea Life

ASSIGNMENTS

Diver #1 __________________________

Diver #2 __________________________

Standby __________________________

DIVER READINESS

1) Divers/personnel on medication:

Name __________________ Medication___________________________

Name__________________ Medication __________________________

2) All divers Clear: YES / NO

3) Any personnel completed a dive in the previous 12 hours:

Name ________________ Profile ________________________________

4) Does any diver intend to fly within 12-hours after making these dives

5) Any divers wearing contact lenses or false teeth:

Name __________________ Type___________________________

Name__________________ Type __________________________

6) Any diver have pre-existing medical or neurological conditions that the Dive Supervisor should be aware of:

Name __________________ Condition ________________________________

Name __________________ Condition ________________________________

**NOTE: All divers should note their physical condition both before and after each dive. Report any symptoms, developing conditions, or concerns to the Diving Supervisor.

COMMUNICATION

1) As required, verify communication equipment is operational, and ensure that local support agencies and facilities are availability to provide medical response support:

Cell Phone ______

Satellite Phone ______

VHF _______

Local Police ______

Local Ambulance ________

Local Medical Facility _________

USCG Air Operations _________

Local recompression chamber _________

SAFETY

If at anytime the USA personnel feel that unsafe situations are occurring, the diver will not enter the water until complete resolution of the procedures or conditions are resolved.

All divers and support personnel will function as safety observers during all activities, and will maintain the authorization to direct the cessation of site operations if a safety concern is identified.

CASUALTY RESPONSE ASSIGNMENTS

In the event of a casualty, the Dive Supervisor will take charge of the side, assess the situation, and direct required response actions.

Pre-assigned positions consist of the following:

1) Boat Coxswain
- Contact local medical response agencies as required
- Immediately prepare to get underway

2) Dive Tender
- Provide CPR and/or administering emergency oxygen

Remaining personnel will secure equipment for transit, provide additional First Aid, and provide additional support as directed by the Dive Supervisor.

EMERGENCY PROCEDURES

Review emergency procedures, as listed in the Dive Safe Practices Manual, for the following events:

1) Entrapped or fouled diver
2) Loss of vital support equipment
3) Loss of gas supply
4) Loss of communication
5) Lost diver plan
6) Injured diver
7) Discovery of fire
8) Diver blow up/over rapid ascent to surface
9) Diver loss of consciousness
10) Injury/illness of member of surface crew with diver in the water
11) Adverse Weather Conditions.

QUESTIONS

If there are no questions, complete all preparations for diving.

SAMPLE FORMS: DIVE SUPERVISOR CHECK LIST

DATE: ____________

A. PRE DIVE EQUIPMENT INSPECTION COMPLETED	
B. DIVER COMMUNICATION SYSTEM CHECKED	
C. DIVE/CODE ALFA FLYING	

DIVERS	#1	#2	Standby
Fins			
Mask			
Knife (Not jettisonable)			
Sufficient Weight			
Watch			
Tank Pressure	PSI	PSI	PSI
Bailout Bottle properly rigged and charged			
Verify quick release straps are accessible and properly rigged			
Verify divers have sufficient weight for the dive			
Harness and tending line properly rigged to not obstruct removal of dive gear			
Verify that the B/C it is not constricted			
Verify operation of B/C power inflator and dump valve			
Verify the cylinder valve is opened fully and backed off 1/4 turn			
Have diver(s) breath through both regulators (primary and bailout bottle)			
Reiterate the depth of the dive and the maximum bottom time			
Reiterate the purpose of the dive and diver tasks			
Direct divers to enter the water and conduct in-water checks			

Dive Supervisor Name

Dive Supervisor Signature

SAMPLE FORMS: SCUBA DIVE LOG

Date:	**Geographic Location:**		**Air Temp (F):**
Project:		**Dive System Type:**	**Wave Height (ft):**
Breathing Medium:		**Dive Platform:**	**Water Temp (F):**
Dive Supervisor:	**Purpose:**	**Tools Used:**	**Current (knots):**
Bottom Type:		**In-Water Visibility:**	

Diver (Last Name, First Name)	Max Depth	LS	RB	LB	RS	RNT	TBT	Single Equivalent Dive Time	TDT	TTD	Table & Schedule Used /Repet Group	Surface Interval
Standby												

Diving Supervisor Name

Diving Supervisor Signature

ATTACHMENT 2

STANDARD OPERATING PROCEDURES

DIVING STANDARD OPERATING PROCEDURE
DSOP-01: SCUBA PRE DIVE BRIEF

****This pre dive brief will be conducted each work day diving operations are planned, and will be completed in concert with other required project Safety meetings and Tailgate Safety Briefs.**

****Underwater explosive disposal events will also require completion of a task specific safety and operations brief.**

DATE ____________________

DIVE SUMMARY

Purpose of the Dive: ____

Diving System in Use: ____

Location of Dive Site: ____

Boat Platform or Land Based Dive Side ____

Special Tools/Equipment ____

DIVE PROFILE

Planned Table/Schedule: ________ FSW /__________ (min)

Repet Group: __________

Non-Decompression Limits for Anticipated dive depth: _____ (min)

Non-Decompression Limits for next deeper dive profile: ________ FSW /__________ (min)

Divers will not exceed a depth of ________(FSW) during the dive

Diver will not exceed a bottom time of _________(min) during the dive

SITE CONDITIONS

1) Water Temp ___________

2) Air Temp ___________

3) Wind Speed ____________ Direction ____________

4) Sunrise ________________ Sunset __________

5) Surface Conditions/Wave Height _____________

6) Low Tide ______________ High Tide __________

7) Anticipated Current _______ Direction _______________

8) Bottom Type ___________

9) In-Water Visibility __________

ANTICIPATED SITE HAZARDS

1) Boat Traffic
2) Weather Related Hazards
3) Unexploded Ordnance
4) Sea Life

ASSIGNMENTS

Diver #1 __________________________

Diver #2 __________________________

Standby __________________________

DIVER READINESS

1) Divers/personnel on medication:

Name __________________ Medication___________________________

Name__________________ Medication __________________________

2) All divers Clear: YES / NO

3) Any personnel completed a dive in the previous 12 hours:

Name ________________ Profile ________________________________

4) Does any diver intend to fly within 12-hours after making these dives

5) Any divers wearing contact lenses or false teeth:

Name __________________ Type___________________________

Name__________________ Type __________________________

6) Any diver have pre-existing medical or neurological conditions that the Dive Supervisor should be aware of:

Name __________________ Condition ________________________________

Name __________________ Condition ________________________________

**NOTE: All divers should note their physical condition both before and after each dive. Report any symptoms, developing conditions, or concerns to the Diving Supervisor.

COMMUNICATION

1) As required, verify communication equipment is operational, and ensure that local support agencies and facilities are availability to provide medical response support:

Cell Phone ______

Satellite Phone ______

VHF _______

Local Ambulance ________

USCG Air Operations _________

Local recompression chamber _________

SAFETY

If at anytime the USA personnel feel that unsafe situations are occurring, the diver will not enter the water until complete resolution of the procedures or conditions are resolved.

All divers and support personnel will function as safety observers during all activities, and will maintain the authorization to direct the cessation of site operations if a safety concern is identified.

CASUALTY RESPONSE ASSIGNMENTS

In the event of a casualty, the Dive Supervisor will take charge of the side, assess the situation, and direct required response actions.

Pre-assigned positions consist of the following:

1) Boat Coxswain
- Contact local medical response agencies as required
- Immediately prepare to get underway

2) Dive Tender
- Provide CPR and/or administering emergency oxygen

Remaining personnel will secure equipment for transit, provide additional First Aid, and provide additional support as directed by the Dive Supervisor.

EMERGENCY PROCEDURES

Review emergency procedures, as listed in the Dive Safe Practices Manual, for the following events:

1) Entrapped or fouled diver
2) Loss of vital support equipment
3) Loss of gas supply
4) Loss of communication
5) Lost diver plan
6) Injured diver
7) Discovery of fire
8) Diver blow up/over rapid ascent to surface
9) Diver loss of consciousness
10) Injury/illness of member of surface crew with diver in the water
11) Adverse Weather Conditions.

QUESTIONS

Following questions, complete all preparations for diving.

____________________________ Dive Supervisor Name

____________________________ Dive Supervisor Signature

DIVING STANDARD OPERATING PROCEDURE
DSOP-02: DIVE SUPERVISOR CHECK LIST

DATE: ____________

A. PRE DIVE EQUIPMENT INSPECTION COMPLETED	
B. DIVER COMMUNICATION SYSTEM CHECKED	
C. DIVE/CODE ALFA FLYING	

DIVERS	**#1**	**#2**	**Standby**
Fins			
Mask			
Knife (Not jettisonable)			
Sufficient Weight			
Watch			
Tank Pressure	PSI	PSI	PSI
Bailout Bottle properly rigged and charged			
Verify quick release straps are accessible and properly rigged			
Verify divers have sufficient weight for the dive			
Harness and tending line properly rigged to not obstruct removal of dive gear			
Verify that the B/C it is not constricted			
Verify operation of B/C power inflator and dump valve			
Verify the cylinder valve is opened fully and backed off 1/4 turn			
Have diver(s) breath through both regulators (primary and bailout bottle)			
Reiterate the depth of the dive and the maximum bottom time			
Reiterate the purpose of the dive and diver tasks			
Direct divers to enter the water and conduct in-water checks			

Dive Supervisor Name

Dive Supervisor Signature

DIVING STANDARD OPERATING PROCEDURE
DSOP-03: SCUBA DIVE LOG

Date:	**Geographic Location:**		**Air Temp (F):**
Project:	**Dive System Type:**		**Wave Height (ft):**
Breathing Medium:	**Dive Platform:**		**Water Temp (F):**
Dive Supervisor:	**Purpose:**	**Tools Used:**	**Current (knots):**
Bottom Type:	**In-Water Visibility:**		

Diver (Last Name, First Name)	Max Depth	LS	RB	LB	RS	RNT	TBT	Single Equivalent Dive Time	TDT	TTD	Table & Schedule Used /Repet Group	Surface Interval
Standby												

Diving Supervisor Name

Diving Supervisor Signature

DIVING STANDARD OPERATING PROCEDURE
DSOP-04: DIVE EQUIPMENT LOADOUT

DATE: _____________

Dive Equipment

Item	Quantity	Inspected for operation and Loaded
DIVE FLAG (CIVILIAN AND CODE ALPHA)		
LOST DIVER BUOY		
TENDING LINES AND HARNESSES		
GPS		
BUDDY LINES		
REGULATORS AND BC		
BOTTLES		
CELLULAR PHONE (ON AND CHARGED)		
VHF RADIO		
DRINKING WATER W/CUPS		
PERSONAL DIVE GEAR		
DIVE OPS WORK PLAN		
DIVE SAFE PRACTICES MANUAL		
U.S. NAVY DIVE MANUAL (Copy)		
EMERGENCY CONTACT LIST POSTED		
REQUIRED LINES, BUOYS, ANCHORS		

Medical Equipment

Item	Quantity	Inspected for operation and Loaded (Note PSI of Oxygen Systems)
FIRST AID KIT		
EMERGENCY OXYGEN SYSTEM		**PSI**
STRETCHER OR BACKBOARD		

Tools, UXO Related Equipment, Explosive Materials

Item	Quantity	Inspected for operation and Loaded

Name of Person Supervising Loadout

Signature

DIVING STANDARD OPERATING PROCEDURE
DSOP-05: DIVE SYSTEM EQUIPMENT INSPECTION

DATE:_______________

	Cylinders				Regulators/ Gages		Buoyancy Compensators	
	Singles		Doubles					
	Pre-Dive	Post Dive	Pre-Dive	Post Dive	Pre-Dive	Post Dive	Pre-Dive	Post Dive
#	Inspect	Clean and Charge (PSI)	Inspect	Clean and Charge (PSI)	Inspect/Test	Clean and Inspect	Inspect/Test	Clean/Inspect
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Notes:
1) Divers complete and initial each block prior to and after each dive. Place PSI level in block as indicated.
2) Ensure all bottles have 2500 PSI minimum following charge

Cylinders
Rinse cylinders
Leak check cylinders during charging

BC
Rinse and clean BC
Inspect BC inflation and dump valves
Inflate and leave overnight for drying and leak check

Regulators/Gages
Rinse & sterilize regulator
Inspect regulator & hoses
Rinse & inspect gauges

____
Diving Supervisor Name

____
Diving Supervisor Signature

DIVING STANDARD OPERATING PROCEDURE
DSOP-06: LINE PULL AND HAND SIGNALS

LINE PULL SIGNALS

FROM TENDER TO DIVER		SEARCHING SIGNALS (WITHOUT CIRCLING LINE)	
1 PULL	"ARE YOU ALL RIGHT? WHEN DIVER IS DESCENDING, ONE PULL MEANS STOP".	7 PULLS	"GO ON (OR OFF) SEARCHING SIGNALS".
2 PULLS	"GOING DOWN". DURING ASCENT 2 PULLS MEANS "YOU HAVE COME UP TO FAR, GO BACK DOWN UNTIL WE STOP YOU".	1 PULL	"STOP AND SEARCH WHERE YOU ARE".
3 PULLS	"STANDBY TO COME UP".	2 PULLS	"MOVE DIRECTLY AWAY FROM THE TENDER IF GIVEN SLACK: MOVE TOWARD THE TENDER IF A STRAIN IS TAKEN ON THE LINE".
4 PULLS	"COME UP".	3 PULLS	"FACE YOUR UMBILICAL, TAKE A STRAIN, MOVE RIGHT".
2-1 PULLS	"I UNDERSTAND" OR "TALK TO ME"	4 PULLS	"FACE YOUR UMBILICAL, TAKE A STRAIN, MOVE LEFT".
3-2 PULLS	"VENTILATE"		
4-3 PULLS	"CIRCULATE"		

FROM DIVER TO TENDER		SEARCHING SIGNALS (WITH CIRCLING LINE)	
1 PULL	"I AM OK" WHEN DESCENDING ONE PULL MEANS STOP	7 PULLS	SAME
2 PULLS	"LOWER OR GIVE ME SLACK"	1 PULL	SAME
3 PULLS	"TAKE UP MY SLACK"	2 PULLS	"MOVE AWAY FROM THE WEIGHT"
4 PULLS	'HAUL ME UP"	3 PULLS	"FACE THE WEIGHT AND GO RIGHT"
2-1 PULLS	"I UNDERSTAND OR TALK TO ME"	4 PULLS	"FACE THE WEIGHT AND GO LEFT"
3-2 PULLS	"MORE AIR"		
4-3 PULLS	"LESS AIR"		

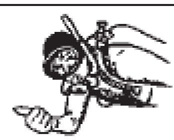
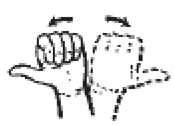
SPECIAL SIGNALS FROM THE DIVER		EMERGENCY SIGNALS FROM THE DIVER	
1-2-3 PULLS	"SEND ME A SQUARE MARK"	2-2-2 PULLS	"I AM FOULED AND NEED ASSISTANCE OF ANOTHER DIVER"
5 PULLS	"SEND ME A LINE"	3-3-3 PULLS	"I AM FOULED BUT CAN CLEAR MYSELF"
2-1-2 PULLS	"SEND ME A SLATE"	4-4-4 PULLS	"HAUL ME UP IMMEDIATELY"
		ALL EMERGENCY SIGNALS SHALL BE ANSWERED AS GIVEN EXCEPT 4-4-4	

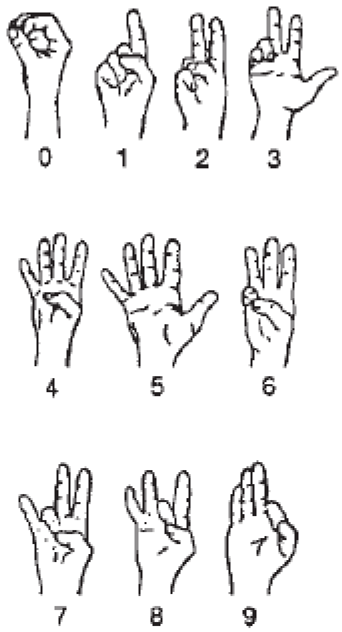
SITE SPECIFIC LINE PULL SIGNALS

Fill in As Required			

HAND SIGNALS

	Meaning/Signal	Comment
	**STOP** Clenched fist.	
	**SOMETHING IS WRONG** Hand flat, fingers together, palm out, thumb down then hand rocking back and forth on axis of forearm.	This is the opposite of Okay. The signal does not indicate an emergency.
	**I AM OKAY or ARE YOU OKAY?** Thumb and forefinger making a circle with three remaining fingers extended (if possible).	Divers wearing mittens may not be able to extend three remaining fingers distinctly. Short range use.
	**OKAY ON THE SURFACE (CLOSE)** Right hand raised overhead giving Okay signal with fingers. **OKAY ON THE SURFACE (DISTANT)** Both hands touching overhead with both arms bent at 45° angle.	Given when diver is close to pickup boat. Given when diver is at a distance from the pickup boat.
	**DISTRESS or HELP or PICK ME UP** Hand waving overhead (diver may also thrash hand in water).	Indicates immediate aid is required.
	**WHAT TIME? or WHAT DEPTH?** Diver points to either watch or depth gauge.	When indicating time, this signal is commonly used for bottom time remaining.
	**GO DOWN or GOING DOWN** Two fingers up, two fingers and thumb against palm.	
	**GO UP or GOING UP** Four fingers pointing up, thumb against palm.	
	**I'M OUT OF AIR** Hand slashing or chopping at throat. **I NEED TO BUDDY BREATHE** Fingers pointing to mouth or regulator.	Indicates signaler is out of air. Signaler's regulator may be in or out of mouth.

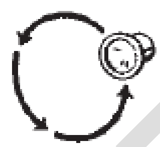
	Meaning/Signal	Comment
	**COME HERE** Hand to chest, repeated.	
	**ME or WATCH ME** Finger to chest, repeated.	
	**OVER, UNDER, or AROUND** Fingers together and arm moving in and over, under, or around movement.	Diver signals intention to move over, under, or around an object.
	**LEVEL OFF or HOW DEEP?** Fingers and thumb spread out and hand moving back and forth in a level position.	
	**GO THAT WAY** Fist clenched with thumb pointing up, down, right, or left.	Indicates which direction to swim.
	**WHICH DIRECTION?** Fingers clenched, thumb and hand rotating right and left.	
	**EAR TROUBLE** Diver pointing to either ear.	Divers should ascend a few feet. If problem continues, both divers must surface.
	**I'M COLD** Both arms crossed over chest.	
	**TAKE IT EASY OR SLOW DOWN** Hand extended, palm down, in short up-and-down motion.	
	**YOU LEAD, I'LL FOLLOW** Index fingers extended, one hand forward of the other.	



NIGHT DIVING SIGNALS
(Buddy at Distance)

When buddy is near, use regular hand signals in front of light.

Something is wrong.
I require assistance.
(Large, rapid up-and-down motions with arm extended.)



I am Okay.
Are you Okay?
(Large, slow circles with light.)

STANDARD OPERATING PROCEDURE
DSOP-07: UNDERWATER EXCAVATION OPERATIONS

1.0 PURPOSE

This Standard Operating Procedure (SOP) will be used to provide the minimum procedures and safety and health requirements applicable to the conduct of underwater excavation on sites contaminated with unexploded ordnance (UXO) or munitions and explosives of concern (MEC).

2.0 SCOPE

This SOP applies to all USA Environmental, Inc. (USA) site personnel, including contractor and subcontractor personnel, involved in the conduct of underwater excavation on a UXO/MEC contaminated site. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with approved project plans and other applicable guidance.

3.0 EXCAVATION OPERATIONS

Underwater excavations will be performed when required in order to investigate items buried in the seafloor. Excavations may be completed manually by hand if the targeted item is small in size and buried at a shallow depth. For items larger in size and buried deep within the seafloor, excavating with mechanical equipment can be performed.

Due to the nature of excavating in the seafloor, the radius of the excavation will need to extend significantly outward from the marked location of the targeted item. The maximum depth of each excavation will be determined by the bottom composition, in-water visibility, and anticipated underwater conditions. Excavations will cease if the size, depth, or possibility of unnecessary disturbance of the target anomaly may result in an unsafe situation for the diver.

4.0 EQUIPMENT DESCRIPTION

The type of equipment utilized for underwater excavation will be dependant on several factors, including the performance requirements, size of the intended operating platform, and logistical availability of equipment. In general, the equipment selected should be able to perform the required excavation in an efficient and safe manner.

Mechanical excavation equipment will consist of a variable volume, hydro-excavation unit. This unit is composed of a gasoline powered suction pump situated on the primary diving platform or dive side. A suction hose extends from the pump, and is carried by the diver to the excavation site. Suctioned bottom material is cycled through the pump components, and deposited through a discharge hose. This configuration will allow the diver to perform the excavation without creation of a sediment cloud that could affect visual recognition of the excavation process, or identification of the intended target item.

Once identified, the User Manual and Operator Guide for the equipment will be reviewed with all personnel that will operate the equipment, and will be available on-site.

5.0 GENERAL SAFETY PROCEDURE

All personnel, including contractor and subcontractor personnel, involved in underwater excavations on UXO/MEC-contaminated sites will be familiar with the potential safety and health hazards, and with the work practices and control techniques used to reduce or eliminate these hazards.

The equipment User Manual and Operator Guide will be utilized to identify equipment specific safety concerns. In addition, the following general procedures are provided to ensure the safe and effective completion of underwater excavations:

- Unless otherwise planned and authorized, no physical contact with UXO/MEC will be made during underwater excavations
- In-water voice communication systems between the diver and topside will be utilized during all mechanical excavation events
- Hand-held tools and equipment shall be de-energized before being placed into or retrieved from the water
- Equipment shall not be supplied with power from the dive location until requested by the diver
- Divers will avoid placing any part of the body in close proximity to the opening of the suction hose
- Underwater excavations will be completed at a slow and methodical pace, especially in limited visibility conditions
- Operations will cease at any time when safety concerns develop in relation to underwater conditions or the potential for collapse/cave in of the excavation
- As required, utilize chase boats, marker buoys, U.S. Coast Guard assets, and local law enforcement agencies to establish and maintain water surface and underwater exclusion areas
- Equipment should be properly secured, and located as far as possible from the dive side to avoid engine noise from interfering with communications
- All associated hoses routed to avoid trip hazard
- Fuel powered systems will only be operated in well ventilated spaces. Spill containment procedures will be followed when refueling equipment
- Hearing protection will be worn by all personnel in close proximity to the operating system as required.

More detailed operating and safety procedures will be dependant on the operating location and specific equipment type.

6.0 SPECIAL REQUIREMENTS FOR UNDERWATER EXCAVATIONS

The presence of sensitive marine habitats or protected marine species may exist in the area where excavations are intended. It is imperative to be aware of applicable regulations regarding sensitive marine habits, and comply with all guidelines. Refer to specific, site related information outlined in the associated work plans or provided by other guidance documents.

7.0 REFERENCES

Applicable sections and paragraphs in the documents listed below will be used as references for the conduct of underwater excavations:

- USA Corporate Safety and Health Program
- Basic Safety Concepts and Considerations for Ordnance and Explosives Operations, EP 385-1-95a
- OSHA 29 CFR 1910, Subpart T- Commercial Diving Operations
- USACE EM 385-1-1, Safety and Health Requirements Manual
- Selected excavator equipment User’s Manual and Operations Checklist

STANDARD OPERATING PROCEDURE
DSOP-08: UNDERWATER OPERATIONS IN MARINE HABITATS

1.0 PURPOSE

This Standard Operating Procedure (SOP) will be used to provide the minimum procedures for conducting underwater operations within areas containing marine habitats or sensitive/protected marine life. Awareness of these areas, and enacting specific guidelines and procedural limits, is critical to protect the overall marine environment and individual species.

2.0 SCOPE

This SOP applies to all USA Environmental, Inc. (USAE) site personnel, including contractor and subcontractor personnel, involved in the conduct of underwater operations. This SOP is intended to reflect general requirements needed to ensure the safety of marine habitats and species, and should be used in conjunction with approved project plans and other applicable guidance. The contents of this SOP should also be expanded in cases where specific local, state, or federal regulations exist.

3.0 PROTECTED MARINE SPECIES

Underwater environments may be populated with marine life protected by the Endangered Species Act (ESA) or Marine Mammal Protection Act (MMPA). It is illegal to kill, capture, or harass any endangered or protected marine species.

In addition to protected species, underwater environments may also contain abundant fish populations, active reef structures, and sensitive coral formations. These elements of the underwater environment should also be treated in a sensible and responsible manner.

All underwater operations will be planned and executed in a fashion that provides the best protection for the full spectrum of marine life, both protected and general in nature.

4.0 OPERATIONS IN PROXIMITY TO MARINE LIFE

It is anticipated that marine species inhabiting the designated project area may be encountered during execution of field operations. The following minimum procedures will be enacted to ensure the protection of these creatures.

- Boat operators will watch the water's surface for the presence of marine species, and maneuver in a manner to avoid any physical contact
- Diving and Remotely Operated Vehicles (ROV) operations will be conducted in a manner to avoid physical contact or harassment of any protected marine species
- If the boat or ROV is approached by inquisitive protected/endangered marine species while operating, the operator will cease to maneuver and wait for the species to leave the area. Boat engines will be placed in neutral.
- All underwater operations involving active-source SONAR instruments will cease if an adverse reaction from marine life is noted. These situations will be reported to the USAE Corporate Office.
- Any unintentional contact with a marine species that results in a noticeable injury will be reported immediately to the USAE Corporate Office and appropriate authorities.

5.0 ANCHORING

USAE field teams should anchor boats in areas with sand bottoms, and avoid intentionally anchoring directly on rocks, boulders, reef, and existing coral structures.

In areas where sea grasses exist and water visibility allows boat operators to view bottom conditions, attempts will be made to deploy anchors in areas void of any grasses if possible. When operational and safety factors require anchoring in sea grass areas, the following procedures will be followed:

- Anchors will be seated in the sea bottom as quickly as possible, without extensive dragging that will unnecessarily impact sea grass
- When retrieving anchors, the boat will be maneuvered above the anchor in a direct line of pull, and the anchor will be lifted free of its emplacement without dragging/plowing the anchor across the bottom

Prior to commencing field operations, an inquiring should be made regarding any local anchoring restriction or specific procedures for the designated project site.

6.0 ADDITIONAL PROCEDURES

It is anticipated that a regional SOP for conduct of underwater operations will be developed under a coordinated effort by the U.S Army Corps of Engineers and NOAA/NFS. If issued, additional procedures reflected in this guidance document will be incorporated as required..

7.0 REFERENCES

- NOAA National Marine Fisheries Service, Office of Protected Resources, Website, November 2009

ATTACHMENT 3

ACTIVITY HAZARD ANALYSIS

1) Diving Operation

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC) (Use highest code): M

Date prepared: 22 December 2010

Project location: Pineros Island, Puerto Rico

Prepared by: Cheryl M. Riordan, CSP

Job: Diving Operations

Reviewed by: Robert Crownover

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
Brief Pre-dive operations, task assignments, and check equipment. Locate and move to dive area and complete pre-dive checks.	Fire hazards on boat Slips, trips and falls on boat deck Heat Stress Biological hazards – hazardous sealife, bees, wasps, centipedes, ticks, mosquitoes, spiders, and rodents Muscle strain carrying equipment Sunburn Equipment shifting during boat transit in sea states Falling overboard/drowning hazards	Be observant while walking Personnel will wear close toed shoes/boots appropriately soled for working on boat decks Perform proper stowage and securing of equipment on boat prior to transit Assure fire extinguishers and first aid kit are available and operational Assure communications equipment is available and operational Heat stress monitoring, drinking water, work-rest schedule and cool shelter for breaks Training in biological hazards avoidance Use insect repellants as necessary Use proper lifting/carrying techniques Use sunscreen and wear cap Wear personal flotation device at all times while on boat Review specific hazards and controls located in the Dive Plan. Review DSOPs 1,2,3,4,5,6,7,8,9,and 10 as related to current task, assignment, or pre, during, and post dive activities.	L

Approval Authority: ______________________

ACTIVITY HAZARDS ANALYSIS

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
Deploy and recover divers to/from the water.	Fire hazards on boat Falling overboard/drowning hazards Heat Stress Biological hazards – hazardous sealife, bees, wasps, centipedes, ticks, mosquitoes, spiders, and rodents Sunburn Slips, trips, and falls on boat deck. Stability of divers on dive boat when entering and exiting the water.	Be observant while walking Personnel will wear close toed shoes/boots appropriately soled for working on boat decks Personnel will maintain at least three points of contact with boat during transits Divers will be paired with tenders at all times. Tenders will maintain positive control of divers while maneuvering around the dive boat and entering/exiting the water. All personnel trained in diving distress signals Wear personal flotation device at all time while on boat Assure fire extinguishers and first aid kit are available and operational Assure communications equipment is available and operational Heat stress monitoring, drinking water, work-rest schedule and cool shelter for breaks Training in biological hazards avoidance Use insect repellants as necessary Use sunscreen and wear cap	L

Approval Authority: ______________________________

ACTIVITY HAZARDS ANALYSIS

Perform underwater operations including: establishing transects; perform MEC survey; excavate anomalies; identification of MEC.	MEC hazards Drowning hazards Biological hazards – hazardous sealife Hazardous tides or currents Underwater hazards from stepping on coral or other sharp underwater objects. Unauthorized personnel entering area	On-site MEC Training Perform MEC operations using approved methods and techniques Anomalies will be investigated using hand tools, without moving the MEC until it can be identified and inspected Standby diver assigned to the team will be at the ready when diver(s) are in the water All personnel trained in diving distress signals Dive Supervisor equipped with rescue equipment and first aid supplies and equipment Emergency notification communications are available and working Be observant while in water; note, avoid, and report unsafe conditions or activities Determine types of hazardous aquatic life found in this location from local marine or FWS. Training in biological hazards avoidance. If sharks are a hazard in this area, operations will not occur at dawn or at dusk, when they are most likely to be feeding. Personnel will be observant for schools of bait fish on which sharks feed, and leave the area immediately if sited. No flashing jewelry will be worn. Determine areas where hazardous tasks, tides or currents (in excess of 1 knot) may be present and times of day or conditions likely to cause them from local marine or harbor police of lifeguard headquarters. Training in how to safely handle these circumstances. Diving gear will include fins for foot protection, personnel will not work barefoot underwater, and they will remain observant where they step MEC operations will cease if unauthorized watercraft/ personnel enter the area. Personnel will be informed of the site hazards and of the fact that they are not authorized to be in the vicinity of the site operations, and will be asked to leave. MEC operations will not resume until all unauthorized personnel have left the area.	M

Approval Authority: ______________________________

ACTIVITY HAZARDS ANALYSIS

MEC/MPPEH that is acceptable to move will be hand-carried or floated on a watercraft for transport to consolidation point on shore for disposal operations	MEC hazards Drowning hazards Biological hazards – hazardous sealife Hazardous tides or currents Underwater hazards from stepping on coral or other sharp underwater objects. Unauthorized personnel entering area	On-site MEC Training Perform MEC operations using approved methods and techniques The MEC transportation watercraft will contain only the MEC and no occupants Standby diver assigned to the team will be at the ready when diver(s) are in the water All personnel trained in diving distress signals Dive Supervisor equipped with rescue equipment and first aid supplies and equipment Emergency notification communications are available and working Be observant while in water; note, avoid, and report unsafe conditions or activities Determine types of hazardous aquatic life found in this location from local marine or FWS. Training in biological hazards avoidance. If sharks are a hazard in this area, operations will not occur at dawn or at dusk, when they are most likely to be feeding. Personnel will be observant for schools of bait fish on which sharks feed, and leave the area immediately if sited. No flashing jewelry will be worn. Determine areas where hazardous tasks, tides or currents (in excess of 1 knot) may be present and times of day or conditions likely to cause them from local marine or harbor police of lifeguard headquarters. Training in how to safely handle these circumstances. Diving gear will include fins for foot protection, personnel will not work barefoot underwater, and they will remain observant where they step MEC operations will cease if unauthorized watercraft/ personnel enter the area. Personnel will be informed of the site hazards and of the fact that they are not authorized to be in the vicinity of the site operations, and will be asked to leave. MEC operations will nor resume until all unauthorized personnel have left the area.	M

Approval Authority: ______________________________

ACTIVITY HAZARDS ANALYSIS

MEC unacceptable to move will be covered in sandbags and location recorded in GPS	MEC hazards Drowning hazards Biological hazards – hazardous sealife Hazardous tides or currents Underwater hazards from stepping on coral or other sharp underwater objects. Unauthorized personnel entering area	On-site MEC Training Perform MEC operations using approved methods and techniques The MEC items that are unacceptable to move will be left in place. Temporary buoy will be floated above marking the location and location logged in GPS. At least 24 inches of sandbags (non-organic bag material) will be placed over the item. Two to six inches of space will be required between the MEC item and the sand bag enclosure. A warning sign will be posted in the vicinity to warn the public of anchor hazards within 2,500 feet of shore. Standby diver assigned to the team will be at the ready when diver(s) are in the water. All personnel trained in diving distress signals. Dive Supervisor equipped with rescue equipment and first aid supplies and equipment. Emergency notification communications are available and working. Be observant while in water; note, avoid, and report unsafe conditions or activities. Determine types of hazardous aquatic life found in this location from local marine or FWS. Training in biological hazards avoidance. If sharks are a hazard in this area, operations will not occur at dawn or at dusk, when they are most likely to be feeding. Personnel will be observant for schools of bait fish on which sharks feed, and leave the area immediately if sited. No flashing jewelry will be worn. Determine areas where hazardous tasks, tides or currents (in excess of 1 knot) may be present and times of day or conditions likely to cause them from local marine or harbor police of lifeguard headquarters. Training in how to safely handle these circumstances. Diving gear will include fins for foot protection, personnel will not work barefoot underwater, and they will remain observant where they step MEC operations will cease if unauthorized watercraft/ personnel enter the area. Personnel will be informed of the site hazards and of the fact that they are not authorized to be in the vicinity of the site operations, and will be asked to leave. MEC operations will nor resume until all unauthorized personnel have left the area.	

Approval Authority:

ACTIVITY HAZARDS ANALYSIS

Perform post-dive operations and return to shore	Fire hazards on boat Slips, trips and falls on boat deck Heat Stress Biological hazards – hazardous sealife, bees, wasps, centipedes, ticks, mosquitoes, spiders, and rodents Muscle strain carrying equipment Sunburn Equipment shifting during boat transit in sea states Falling overboard/drowning hazards	Be observant while walking Personnel will wear close toed shoes/boots appropriately soled for working on boat decks Perform proper stowage and securing of equipment on boat prior to transit Assure fire extinguishers and first aid kit are available and operational Assure communications equipment is available and operational Heat stress monitoring, drinking water, work-rest schedule and cool shelter for breaks Training in biological hazards avoidance Use insect repellants as necessary Use proper lifting/carrying techniques Use sunscreen and wear cap Wear personal flotation device at all times while on boat Review specific hazards and controls located in the Dive Plan. Review DSOPs 1,2,3,4,5,6,7,8,9,and 10 as related to current task, assignment, or pre, during, and post dive activities.	

EQUIPMENT	TRAINING	INSPECTION
PPE: Footwear with non-slip soles; personal flotation devices	PPE Training	PPE inspected daily prior to use
Boat Diving equipment to include: snorkels, fins, buoyancy compensators, weight belt, dive tanks, regulators, watches, knives, masks, manual reserve (J valve) or authorized independent system. Sand bags Raft with high visibility colors Temporary buoys Warning signs	UXO personnel will meet training and experience requirements outlined in DDESB TP 18, USACE requirements, and OSHA 29 CFR 1910.120, Subpart T. Site-specific hazards to include first aid All site personnel will have current HAZWOPER training All dive team members will review and be briefed on the Dive Plan, Dive SOPs, and this AHA Equipment familiarity training Site-specific training, slip/fall hazards Site-specific flora/fauna to include first aid Lifting carrying techniques	Dive Supervisor will ensure that all controls are being followed; all equipment is being utilized, and all personnel have received appropriate training. Equipment inspected daily prior to use

Approval Authority: ______________________________

ACTIVITY HAZARDS ANALYSIS

EQUIPMENT	TRAINING	INSPECTION
Communications equipment Fire Extinguisher First Aid Kit equipped for surface and waterborne injuries with Oxygen cylinder and mask. WBGT Rescue equipment including ring buoys with rope attached	Training in emergency procedures to include diving distress hand signals and use of rescue equipment. Heat Stress symptoms/first aid	Communications equipment checked daily prior to use Rescue equipment checked daily prior to use First aid kits checked daily and inspected weekly Fire extinguishers checked daily and inspected weekly Daily check of WBGT monitor

Approval Authority: ______________________

Appendix D
Forms

Contents

D-1: CH2M HILL DAILY SAFETY TAILGATE MEETING LOG

Project. Underwater Investigation, Pineros, Ceiba, PR Date: ____________

TOPICS DISCUSSED:

1.
2.
3.
4.
5.
6.
7.

MEETING CONDUCTED BY: SIGNATURE:

MEETING ATTENDEES	
Name/Company	Signature
1.	
2.	
3.	
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25.	

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D-2: UXO PERSONNEL QUALFICATION AND VERIFICATION FORM

CANDIDATE: ______________________ POSITION/LEVEL: ______________________

CONTRACT: ______________________

REVIEW ITEMS		CANDIDATE QUALIFICATIONS	VERIFIED BY/DATE
EXPERIENCE	REQUIRED: AREA AND YEARS		
	ACTUAL: AREA AND YEARS		
EDUCATION	REQUIRED		
	ACTUAL		
CERTIFICATIONS & REGISTRATIONS	REQUIRED		
	ACTUAL		
TRAINING	REQUIRED		
	ACTUAL		
OTHER	REQUIRED		
	ACTUAL		

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CH2MHILL

D-3: SAFE BEHAVIOR OBSERVATION FORM

Safe Behavior Observation Form

☐Federal or ☐Commercial Sector (check one) | ☐Construction or ☐Consulting (check one)

Project Number:	Client/Program:	
Project Name:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			Positive Observations/Safe Work Practices:
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			Questionable Activity/Unsafe Condition Observed:
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			Observer's Corrective Actions/Comments:
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			Observed Worker's Corrective Actions/Comments:
Other…			

For ES Federal Sector projects please email completed forms to: CH2M HILL ES FED Safe Behavior Observation
For ES Commercial Sector projects please email completed forms to: CH2M HILL ES COM Safe Behavior Observation
For CNR ES staff please email completed forms to: cnressafe@ch2m.com

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CH2MHILL

D-4: PRE-TASK SAFETY PLAN

Project: Underwater Investigation- MEC RFI Location: Pineros Island , Ceiba, PR Date:

Supervisor: Job Activity:

Task Personnel:

____

____

____

List Tasks:

Tools/Equipment required for Tasks, (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools, hand tools):

____

____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental **(Check all that apply and review exposures as they will be encountered in the tasks above):**

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__Ergonomics
Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__Pinch points	__ plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__Heights/fall> 6'	__ Overhead Electrical hazards	__ Heat stress
Noise	Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

Hazard Control Measures (Check all that apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tag out __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds Forklift/ Heavy equipment Backup alarms __ Hand/power tools __ Crane w/current inspection __ Proper rigging Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash X FA-CPR trained personnel X Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tag out __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections:	Training: X Hazwaste __ Construction __ Competent person X Task-specific (THA) X Hazcom
Field Notes:			

Supervisor signature:

(Part I)

Project : ______________________________ Date: ______________

TITLE AND NO. OF TECHNICAL SECTION: ______________________________

____

____

____

Work Plan Reference : ______________________________

A. Planned Attendants:

	Name	**Position**	Company
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			

B. Submittals required to begin work:

	Item	Submittal No.	Action Code
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			

I hereby certify that, to the best of my knowledge and belief, the above required materials delivered to the job site are the same as those submitted and approved.

____

____

Project QC Specialist

(continued):

Project : ______________________ Date: ______________

C. Equipment to be used in executing work:

1) ______________________
2) ______________________
3) ______________________
4) ______________________
5) ______________________

D. Work areas examined to ascertain that all preliminary work has been completed:

____

____

E. Methods and procedures for performing Quality Control, including specific testing requirements:

____

____

A. Persons in attendance: See Meeting Attendance Sheet (attached)

The above methods and procedures have been identified from the project plans and will be performed as specified for the Definable Feature of Work.

Project QC Specialist

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Project.: ______________________ Date: ______________

Title and No. of SSWP Section: ______________________

Description and Location of Work Inspected: ______________________

A. Key Personnel Present:

Name	Position	Company

B. Materials being used are in strict compliance with the contract plans and specifications: ☐Yes ☐No

If not, explain: ______________________

C. Procedures and/or work methods witnessed are in strict compliance with the contract specifications: ☐Yes ☐No

If not, explain: ______________________

D. Workmanship is acceptable: ☐Yes ☐No

State where improvement is needed: ______________________

E. Workmanship is free of safety violations: ☐Yes ☐No

If no, corrective action taken: ______________________

____

Project Quality Control Specialist

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CONTRACTOR QUALITY CONTROL DAILY REPORT CONTINUATION SHEET
(ATTACH ADDITIONAL SHEETS IF NECESSARY)

Date: ____________________
Contractor: ____________________
Project: Underwater Investigation- MEC RFI, Pineros Island, Ceiba, PR

• Y=YES; N=NO; SEE REMARKS BLANK=NOT APPLICABLE	
WORK COMPLIES WITH WORK PLAN AS APPROVED IN INITIAL PHASE	

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION, AND LIST PERSONNEL PRESENT

INSPECTIONS PERFORMED & WHO PERFORMED TEST

Project QC Specialist ____________________ Date ____________________

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Project: Underwater Investigation- MEC RFI, Pineros Island, Ceiba, PR
Date:
QC Inspection Team Leader:
Inspection Remarks:
1.)
2.)
3.)
4.)
5.)
6.)
Inspected by   Date

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Project: Underwater Investigation- MEC RFI, Pineros Island, Ceiba, PR
Date:
QC Inspection Team Leader:
Transect ID/Number team is working in:
Y N Have all team members processed instruments through ECA before beginning work day?
Y N Has the team leader documented the daily functional test
Y N Is sweep equipment in accordance with WP requirements?
Y N Is grid cell laid out in conformance with WP requirements?
Y N Does the team execute a smooth sweep of instrument from side to side?
Y N Are team leader log entries current and legible, and include documentation
of morning safety brief, tailgate safety brief, and relevant information regarding
daily functions?
Y N Has the vehicle inspection form been filled out?
Y N Is recovered MEC/MPPEH/MD being managed in conformance with WP?
Other Comments:
Inspected by Date

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(PART I)

Project: Underwater Invesigation, Pineros Island, Ceiba, PR Date: ______________________

Area of Inspection: ____

A. Definable Feature Of Work: Status of Inspection:

I hereby certify that, to the best of my knowledge and belief, the work inspected is complete and all materials and equipment used and work performed were completed in accordance with plans submitted and approved.

____

____

Project QC Specialist

(continued):

(PART II)

MEETING ATTENDANCE LIST
Underwater Investigation, Pineros Island, Ceiba, PR

Meeting:		Date:
Name	**Organization**	**Phone Number**

Project: Underwater Invesigation, Pineros Island, Ceiba, PR	Project Manager: Tom Roth	Project QC Mgr/Staff:

		Preparatory		Initial		Follow-Up		Completion		
Reference Number	Definable Feature of Work	Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

Project: Underwater Invesigation, Pineros Island, Ceiba, PR	Project Manager: Tom Roth	Project QC Mgr/Staff:

Reference Number	Definable Feature of Work	Preparatory		Initial		Follow-Up		Completion		
		Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

Project: Underwater Invesigation, Pineros Island, Ceiba, PR	Project Manager: Tom Roth									Project QC Mgr/Staff:
		Preparatory		Initial		Follow-Up		Completion		
Reference Number	Definable Feature of Work	Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

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Date: ___/____/______
Project: Underwater Invesigation, Pineros Island, Ceiba, PR
Work Task (Milestone/Activity): ____

Survey Period: ___/____/______ through ___/____/______
Method of Surveillance: COR Review

Evaluation of Contractor's Performance: _______

Evaluation

Corrective Action Required: ☐ Yes ☐ No

Narrative Discussion of Contractor's Performance During Survey Period:

Discussion

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Project: Underwater Invesigation, Pineros Island, Ceiba, PR

1) Work Task (Milestone/Activity): ________________________

2) Survey Period: ___/____/______ through ___/____/______

3) Description of the Failure/Deficiency that Precipitated the Corrective Action:

Description

4) Description of the Criterion that the Failure/Deficiency was Evaluated Against:

Description

5) Personnel Involved in the Identification of the Failure/Deficiency, Determination of the Appropriate Corrective Action, Approval of the Corrective Action, and Implementation of the Corrective Action:

6) Description of the Corrective Action that was Required:

Description

7) Date/Time of Implementation of the Corrective Action: ___/____/______

Description

8) Follow-Up Information to Prevent Recurrence of Failure/Deficiency (i.e., Need For Revision of Procedures or Specifications):

9) Personnel Responsible for Follow-Up Work:

10) Planned Date for Follow-Up Surveillance: ___/____/______

11) Other Notes:

Other

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(2)CAR #:	(3)PRIORITY: ☐HIGH ☐NORMAL	(4)DATE PREPARED:

PART A: NOTICE OF DEFICIENCY

(5)PROJECT:	
(6)PROJECT MANAGER:	(7)QC MANAGER/STAFF:
(8)CONSTRUCTION MANAGER:	(9)MEC MANAGER:
(10)ISSUED TO (INDIVIDUAL & ORGANIZATION):	
(11)REQUIREMENT & REFERENCE:	
(12)PROBLEM DESCRIPTION & LOCATION:	
(13)CAP REQUIRED? ☐YES ☐NO	(14)RESPONSE DUE:
(15)ISSUED BY (PRINTED NAME & TITLE): SIGNATURE: DATE:	(16)MANAGEMENT CONCURRENCE:

PART B: CORRECTIVE ACTION

(17)PROPOSED CORRECTIVE ACTION/ACTION TAKEN: NOTE: SUPPORTING DOCUMENTATION MUST BE LISTED ON THE BACK OF THIS FORM AND ATTACHED.	
(18)PART B COMPLETED BY (NAME & TITLE): SIGNATURE: DATE:	(19)QC CONCURRENCE:

PART C: CORRECTIVE ACTION VERIFICATION

(20)CAR VERIFICATION AND CLOSE-OUT: (CHECK ONLY ONE & EXPLAIN STIPULATIONS, IF ANY) ☐APPROVED FOR CLOSURE WITHOUT STIPULATIONS ☐APPROVED FOR CLOSURE WITH FOLLOWING STIPULATIONS COMMENTS/STIPULATIONS:
(21)CLOSED BY (PRINTED NAME & TITLE): SIGNATURE: DATE:

(1) QC Manager: Verify that the total number of pages includes all attachments.

(2) QC Manager: Fill in CAR number from CAR log.

(3) CQC System Manager: Fill in appropriate priority category. High priority indicates resolution of deficiency requires expediting corrective action plan and correction of deficient conditions noted in the CAR and extraordinary resources may be required due to the deficiency's impact on continuing operations. Normal priority indicates that the deficiency resolution process may be accomplished without further impacting continuing operations.

(4) CAR Requestor: Fill in date CAR is initiated.

(5) CAR Requestor: Identify project name, number, CTO, and WAD.

(6) CAR Requestor: Identify Project Manager

(7) CAR Requestor: Identify CQC System Manager.

(8) CAR Requestor: Identify project organization, group, or discrete work environment where deficiency was first discovered.

(9) CAR Requestor: Identify line manager responsible for work unit where deficiency was discovered.

(10) QC Manager: Identify responsible manager designated to resolve deficiency (this may not be work unit manager).

(11) CAR Requestor: Identify source of requirement violated in contract, work planning document, procedure, instruction, etc; use exact reference to page and, when applicable, paragraph.

(12) CAR Requestor: Identify problem as it relates to requirement previously stated. Identify location of work activities impacted by deficiency.

(13) QC Manager: Identify if Corrective Action Plan (CAP) is required. CAP is typically required where one or more of the following conditions apply: CAR priority is High; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent future recurrence.

(14) QC Manager: Identify date by which proposed corrective action is due to QC for concurrence.

(15) QC Manager: Sign and date CAR and forward to responsible manager identified in (10) above.

(16) Responsible Manager: Initial to acknowledge receipt of CAR.

(17) Responsible Manager: Complete corrective action plan and identify date of correction. Typical corrective action response will include statement regarding how the condition occurred, what the extent of the problem is (if not readily apparent by the problem description statement in [12]), methods to be used to correct the condition, and actions to be taken to prevent the condition from recurring. If a CAP is required, refer to CAP only in this section.

(18) Responsible Manager: Sign and date corrective action response.

(19) QC Manager: Initial to identify concurrence with corrective action response from responsible manager.

(20) QC Manager: Check appropriate block to identify if corrective action process is complete so that CAR may be closed. Add close-out comments relevant to block checked.

(21) QC Manager: Indicate document closeout by signing and dating.

Attach clarifications and additional information as needed. Identify attached material in appropriate section of this form.

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE

(1)PROJECT:		
(2)PROJECT MANAGER:	(3)QC MANAGER:	
(4)CAR NO(S) AND DATE(S) ISSUED:		
(5)DEFICIENCY DESCRIPTION AND LOCATION:		
(6)PLANNED ACTIONS	(7)ASSIGNED RESPONSIBILITY	(8) COMPLETION DUE DATE
(9)PROJECT MANAGER SIGNATURE:		

PART B: TO BE COMPLETED BY CQC SYSTEM MANAGER OR DESIGNEE

(10)CAP REVIEWED BY:	DATE:
(11)REVIEWER COMMENTS:	
(12)CAP DISPOSITION: (CHECK ONLY ONE AND EXPLAIN STIPULATIONS, IF ANY) ☐ APPROVED WITHOUT STIPULATIONS ☐ APPROVED WITH STIPULATIONS ☐ APPROVAL DELAYED, FURTHER PLANNING REQUIRED COMMENTS:	
(13)QC MANAGER SIGNATURE:	

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Project. ______________________________ Date: ______________

LOCATION OF WORK: ______________________________

DESCRIPTION OF WORK: ______________________________

WEATHER: ☐(CLEAR) ☐(FOG) ☐(P.CLOUDY) ☐(RAIN) ☐(WINDY)

TEMPERATURE: MIN: _____°F MAX: _____°F

1. Work completed today by subcontractor:

____

____

____

2. Work completed today by QC inspection staff :

____

____

3. All work performed in conformance with Work Plan requirements? ______________________________

If not, explain: ______________________________

____

____

4. Non-conformances/deficiencies reported: ______________________________

____

5. Comments: ______________________________

____

____

____

CERTIFICATION: I certify that the above report is complete and correct and that I, or my representative, have inspected all work identified on this report and have determined to the best of my knowledge and belief that noted work activities are in compliance with work plans and specifications, except as may be noted above.

____

Project QC Specialist

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PROJECT:	NCR No.	Date:
To:		Page1
ORIGINAL—Please return to CH2M HILL		

Item: ______________________

Work Plan Reference : ______________________

Requirement: ______________________

Nonconformance:

Issued by:	Name:	Title: UXOQC	Organization:
Date:			

Disposition: _____ Accept _______ Reject

Details

Disposition Approvals:

UXOQCS Date	FCR Required? Yes No
Project Manager Date	Distribution:

Remarks:

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Root Cause Analysis (RCA)

Root Cause Categories (RCC): Select the RCC numbered below that applies for the root cause (RC) and/or contributing factor (CF) in the first column, then describe the specific root cause and corrective actions in each column.

1. **Lack of skill or knowledge**
2. **Lack of or inadequate operational procedures or work standards**
3. **Inadequate communication of expectations regarding procedures or work standards**
4. **Inadequate tools or equipment**
5. **Correct way takes more time and/or requires more effort**
6. **Short-cutting standard procedures is positively reinforced or tolerated**
7. **Person thinks there is no personal benefit to always doing the job according to standards**

RCC #	Root Cause(s)	Corrective Actions	RC[1]	CF[2]	Due Date	Date Completed	Date Verified

[1] RC = Root Cause; [2] CF = Contributing Factors (check which applies)

Investigation Team Members

Name	Job Title	Date

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date

Determination of Root Cause(s)

For minor losses or near losses the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, to determine the root cause, and to develop recommendations. More complex situations may require the investigation team to revisit the loss site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must use the Root Cause Analysis Flow Chart to assist in identifying the root cause(s) of a loss. Any loss may have one or more "root causes" and "contributing factors". The "root cause" is the primary or immediate cause of the incident, while a "contributing factor" is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the *person* involved in the loss, his or her peers, or the supervisor should be referred to as "personal factors". Causes that pertain to the *system* within which the loss or injury occurred should be referred to as "job factors".

<u>Personal Factors</u>

- Lack of skill of knowledge
- Correct way takes more time and/or requires more effort
- Short-cutting standard procedures is positively reinforced or tolerated
- Person thinks that there is no personal benefit to always doing the job according to standards

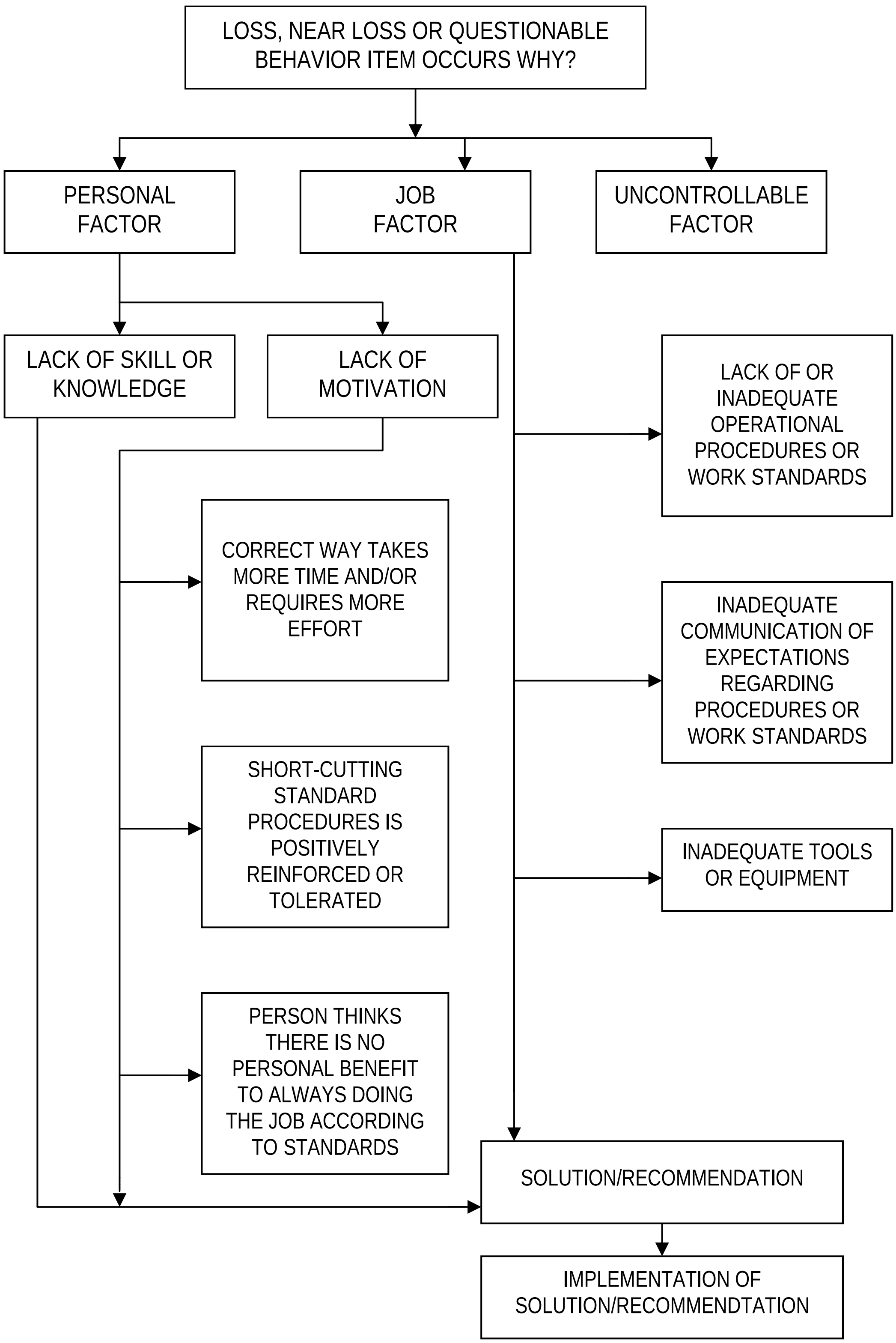
<u>Job Factors</u>

- Lack of or inadequate operational procedures or work standards.
- Inadequate communication of expectations regarding procedures or standards
- Inadequate tools or equipment

The root cause(s) could be any one or a combination of these seven possibilities or some other "uncontrollable factor". In the vast majority of losses, the root cause is very much related to one or more of these seven factors. Uncontrollable factors should be used rarely and only after a thorough review eliminates "all" seven other factors.

Root Cause Analysis
Flow Chart

CH2M HILL, INC.



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Section 1 - Team Information		
TEAM:	LOCATION:	DATE:
TEAM MEMBERS		
NAME	Company	Position

Section 2 - Equipment Serial Numbers			
EQUIPMENT ITEM	Serial #	Equipment Item	Serial #

Section 3 – Checklist

ITEM	Ref.	Inspection Point	Yes	No	N/A	Comments
1	GSV PLAN	EQUIPMENT CHECK PERFORMED IN ECA?	☐	☐	☐	
2	GSV PLAN	DATA COLLECTED IAW WP?	☐	☐	☐	
3	GSV PLAN	WAS PAPERWORK COMPLETED PROPERLY?	☐	☐	☐	
4	GSV PLAN	OBTAIN COPY OF LOGBOOK ENTRIES FROM GEO AND UXO TEAMS.	☐	☐	☐	
5	GSV PLAN	DID TEAM EXPERIENCE ANY PROBLEMS WHILE COMPLETING IVS C?	☐	☐	☐	

Section 4 - Punch list Items	
ITEM #	DESCRIPTION

Conducted by: ____________________________________

Project QC Specialist: ____________

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DATE/TIME: ____________ TRACKING NUMBER (S): ____________

LOCATION: Pineros Island, PR

1. MEC REMOVED FROM SITE ☐ YES ☒ NO

2. WHO REMOVED THE ITEM(S)?

Name: N/A Organization: N/A

3. IF MEC WERE REMOVED, WHERE WERE MEC TAKEN? ☐ DAYBOX ☐ MAGAZINE

4. MEC DESTROYED ONSITE? ☐ YES ☐ NO

5. WHO DESTROYED MEC?

Name: ____________ Organization: ____________

Time of Detonation: ____________ MEC Down Time: ____________

6. MEC ENCOUNTERED:

Tracking No.	Transect ID	Team	MEC Type	Qty

7. GOVT. REPRESENTATIVE NOTIFIED AT (TIME): ____________ REP: ____________

8. PROJECT TEAM PERSONNEL NOTIFIED AT (TIME): ____________ REP: ____________

9. NAVFAC NOTIFIED AT (TIME): ____________ REP: ____________

10. COMMENTS (Significant events or findings): ____________

MEC Representative (Signature) MEC Representative (Print Name)

CHECKED BY ________	APPROVED BY ________

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Appendix E
Biological Assessments

CH2M HILL
Northpark 400
1000 Abernathy Road
Suite 1600
Atlanta, GA 30328
Tel 770.604.9095
Fax 770.604.9183

November 30, 2010

National Marine Fisheries Service
ATTN: Lisamarie Carrubba
USWFS Refuge
PR 301, Km 5.1
Boquerón, PR 00622

Subject: Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern at Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico

Dear Dr. Carrubba:

The enclosed Biological Assessment is being submitted on behalf of our client, Naval Facilities Engineering Command and BRAC PMO Southeast.

The U.S. Navy seeks NMFS concurrence with the Biological Assessment for proposed RFI activities. The proposed activities are not expected to adversely impact any listed threatened or endangered species. We anticipate starting work on or about March 1, 2011.

The U.S. Navy POC for the Pineros Island project is Mr. Mark Davidson (843-743-2124; mark.e.davidson@navy.mil). Mr. Davidson's mailing address is: BRAC PMO SE, Attn: Mark Davidson, 4130 Faber Place Dr., Suite 202, N. Charleston, SC 29405.

Sincerely,

CH2M HILL

Thomas M. Roth

Thomas M. Roth
Principal Project Manager

cc (w/enclosure): Mr. Mark Davidson, BRAC PMO SE
Mr. Pedro Ruiz, Naval Activity Puerto Rico
Mr. Stacin Martin, NAVFAC

CH2M HILL
Northpark 400
1000 Abernathy Road
Suite 1600
Atlanta, GA 30328
Tel 770.604.9095
Fax 770.604.9183

November 30, 2010

U.S. Fish & Wildlife Service
ATTN: Edwin E. Muniz, Field Supervisor
Road 301, Km 5.1
Sector Corozo
Boquerón, PR 00622

Subject: Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern at Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico

Dear Mr. Muniz:

The enclosed Biological Assessment is being submitted on behalf of our client, Naval Facilities Engineering Command and BRAC PMO Southeast.

The U.S. Navy seeks USFWS concurrence with the Biological Assessment for proposed RFI activities. The proposed activities are not expected to adversely impact any listed threatened or endangered species. We anticipate starting work on or about March 1, 2011.

The U.S. Navy POC for this project is Mr. Mark Davidson (843-743-2124; mark.e.davidson@navy.mil). Mr. Davidson's mailing address is: BRAC PMO SE, Attn: Mark Davidson, 4130 Faber Place Dr., Suite 202, N. Charleston, SC 29405.

Sincerely,

CH2M HILL

Thomas M. Roth

Thomas M. Roth
Principal Project Manager

cc (w/enclosure): Mr. Mark Davidson, BRAC PMO SE
Mr. Pedro Ruiz, Naval Activity Puerto Rico
Mr. Stacin Martin, NAVFAC

Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern

Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

Contract Task Order JM03

November 2010

Prepared for

Base Realignment and Closure
Program Management Office SE

Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

CH2MHILL

Chantilly, Virginia

BIOLOGICAL ASSESSMENT FOR

INVESTIGATION OF UNDERWATER

MUNITIONS AND EXPLOSIVES OF CONCERN

Prepared by: Richard Reaves Date: 11/23/10

Richard Reaves, Ph.D.
Endangered Species Biologist
CH2M HILL

Reviewed by: James E. Anderson Date: 11/23/10

James E. Anderson
Director, Navy BRAC PMO SE

Table of Contents

Page

LIST OF FIGURES

Page

LIST OF ACRONYMS AND ABBREVIATIONS

BA	Biological Assessment
ESA	Endangered Species Act
EFH	Essential Fish Habitat
GPS	global positioning system
MEC	munitions and explosives of concern
MPPEH	material potentially presenting an explosive hazard
NAPR	Naval Activity Puerto Rico
NAVSTA	Naval Station
NMFS	National Marine Fisheries Service
U.S.	United States
USN	United States Navy
USFWS	U.S. Fish and Wildlife Service

1. SUMMARY OF DETERMINATIONS

This United States Navy (USN) biological assessment (BA) has formulated a determination regarding the potential effects on six federally listed species resulting from the investigation and removal of munitions and explosives of concern (MEC) and material potentially presenting an explosive hazard (MPPEH) from the waters around Isla Piñeros and the potential effects on eight federally listed species from demolition and demilitarization of MEC/MPPEH through controlled detonation at a designated MEC/MPPEH demolition/processing site on Isla Piñeros.

The USN proposes to investigate and remove underwater MEC/MPPEH from offshore areas near Isla Piñeros using only hand tools, transport the recovered underwater MEC/MPPEH to a designated detonation site on Isla Piñeros, and demolish and/or demilitarize the recovered MEC/MPPEH on the surface of the island. A series of transects will be established using ropes attached onshore. Each rope will define a transect six feet wide, resulting in the investigation of approximately ten percent of each underwater investigation area. Divers will pull ropes across the investigation area to establish transects. Anomalies identified along transects will be investigated.

Geophysical anomalies identified as potentially representing underwater MEC/MPPEH will be intrusively investigated manually to determine the source of each geophysical anomaly. MEC/MPPEH that is exposed or only shallowly buried would be removed by hand and transported to the beach for demolition. Anomalies that are deeply buried or that are located in areas where removal of the item could result in damage to sensitive species, such as in hard or soft coral areas, will be accurately mapped and left in place for later investigation. Exposed or shallowly buried MEC/MPPEH that can be safely moved will be recovered from the offshore locations and transported to a designated MEC/MPPEH demolition/processing site on Isla Piñeros, where it will be demolished and/or demilitarized by controlled detonation using donor explosives. All demolition events will be covered with sandbags to mitigate the blast effects and to reduce the risk of shrapnel being ejected.

The site for detonation of MEC removed from underwater would be established on Isla Piñeros. The terrestrial detonation site will be selected and established to minimize the potential for impacts to protected species. It will not be located in lagoon areas. The detonation site would be placed on beaches, to minimize the distance that MEC must be transferred for detonation. A qualified biologist will inspect the beach that would be used for MEC detonation for the presence of sea turtles prior to establishment of the MEC detonation site. **There will be no underwater detonations as part of this work.** Potential MEC items that cannot be safely transported to the beach for demolition would be mapped and left in place.

An area not used by sea turtles and at least 100 meters from any place of active sea turtle use would be selected as the detonation site. During MEC/MPPEH transfer and demolition/processing, a qualified observer would continue to survey the beaches for signs of sea turtle activity. No human activity would occur until beaches are clear of sea turtles. Any active sea turtle nests will be marked and a 100-meter protection zone will be created around each nest to prevent incidental damage during MEC detonation. No vegetation clearing or ordnance detonation would occur within the protection zone.

The underwater MEC/MPPEH investigation/removal areas are near beaches. No MEC/MPPEH investigation/removal in these three areas will be conducted during the 48-hour period following the emergence of Hawksbill hatchlings on the associated beach.

A qualified biologist will verify locations of seagrasses prior to the start of MEC/MPPEH removal. In areas where seagrasses grow, MEC/MPPEH that can be removed without disturbing the root system of the seagrasses will be recovered and transported to the designated MEC/MPPEH demolition/disposal area for processing. Additionally, exposed or shallowly buried MEC/MPPEH that can be removed by hand while maintaining the integrity of the root/rhizome structure of seagrasses also will be recovered and transported for demolition and processing. In these areas, intact plugs of seagrass will be removed and then replanted following removal of the MEC/MPPEH.

USN completed consultation under the Endangered Species Act (ESA) with National Marine Fisheries and the U.S. Fish and Wildlife Service (USFWS) in 2006 to allow investigations to locate potential MEC on Isla Piñeros and in the shallow waters around the island. This earlier consultation identified the following protected species as potentially occurring in the waters around Isla Piñeros:

- Hawksbill Sea Turtle
- Leatherback Sea Turtle
- Green Sea Turtle
- West Indian Manatee
- Elkhorn Coral
- Staghorn Coral

Previous work and additional consultation in 2008 identified that the sea turtles, four protected birds (piping plover, roseate tern, brown pelican, yellow-shouldered blackbird), and two snakes (the Puerto Rican boa and the Virgin Islands tree boa) could occur on Isla Piñeros. The USN conducted separate consultation with the USFWS regarding the removal of MEC from previously investigated terrestrial areas on Isla Piñeros. Procedures developed in this previous consultation for terrestrial detonation of MEC will be used to implement onshore detonation of MEC removed from underwater.

The three sea turtle species and the West Indian manatee may occur in or adjacent to underwater areas where MEC/MPPEH investigation/removal would occur. A qualified biologist will train all team members on the identification of sea turtles and manatees, and on the signs of sea turtle nesting. A trained qualified observer will scan the area during all MEC/MPPEH investigation, removal, and handling activities to ensure that no turtles or manatees are within visual range of underwater operations. If the qualified observer or any other personnel observe manatees or sea turtles, all investigation, removal, and handling operations will cease until they have left the visual observation area.

Elkhorn and staghorn coral occur in reefs adjacent to Isla Piñeros. Site investigations conducted on July 19, 2006, identified areas where coral reefs occurred and also areas that contained either elkhorn or staghorn coral. These identified areas were mapped so that they could be accommodated without impact during MEC removal. A qualified biologist will verify the distribution of corals prior to the start of MEC/MPPEH removal.

On October 10, 2009, NMFS received a petition from the Center for Biological Diversity to list 83 species of coral as threatened or endangered under the ESA and to designate critical habitat for the corals listed in the petition. Initial review of the petition identified 82 of these coral species as warranting further review for a status determination. Seven of those 82 species are known to occur in waters around Isla Piñeros: *Agaricia lamarcki, Montastraea annularis, Montastraea faveolata, Montastraea franksi, Dendrogyra cylindrus, Dichocoenia stokesii, Mycetophyllia ferox*. While no decision on whether to list these species has been made, there would be no potential to impact the corals currently under consideration for listing under the ESA from this action because USN would avoid intrusive work in areas with hard or soft corals.

Potential impacts to other protected species may occur during terrestrial detonation of MEC transferred from underwater locations for surface detonation on Isla Piñeros. USN has completed separate consultation with USFWS and NMFS regarding MEC removal from the surface of Isla Piñeros. The three sea turtles listed above and the following six additional protected species have the potential to occur on Isla Piñeros:

- Piping Plover
- Roseate Tern
- Brown Pelican
- Yellow-shouldered Blackbird
- Puerto Rican Boa
- Virgin Islands Tree Boa

The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, is **not likely to affect** elkhorn coral, staghorn coral, hawksbill sea turtle, leatherback sea turtle, green sea turtle, and West Indian manatee. Additionally, the proposed MEC removal would not threaten the continued existence of these species.

The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, is **not likely to affect** hawksbill sea turtle, leatherback sea turtle, green sea turtle, piping plover, roseate tern, brown pelican, yellow-shouldered blackbird, Puerto Rican boa, and Virgin Islands tree boa and that the MEC detonation would not threaten the continued existence of these species.

Should any MEC be identified that cannot be transferred to a surface detonation site, USN would initiate separate consultation with USFWS and NMFS at a later date to develop appropriate mitigation that would allow underwater detonation in-place without impacts to protected marine species that are covered in this determination and also any other protected species that may utilize Isla Piñeros. Additionally, concurrent with consultation regarding underwater demolition and protected species, USN also would consult with NMFS regarding potential impacts to Essential Fish Habitat (EFH) if underwater detonation is determined to be necessary.

2. INTRODUCTION

This document is being submitted to fulfill requirements under Section 7 of the Endangered Species Act (ESA). This BA by the USN addresses potential impacts to protected species associated with the investigation and removal of MEC/MPPEH from waters around Isla Piñeros, Puerto Rico. Previous consultation with NMFS and USFWS regarding investigations to determine whether MEC occurred in these areas identified the following protected species as potentially occurring in the waters around Isla Piñeros:

- Hawksbill Sea Turtle (*Eretmochelys imbricata*)
- Leatherback Sea Turtle (*Dermochelys coriacea*)
- Green Sea Turtle (*Chelonia mydas*)
- West Indian Manatee (*Trichechus manatus*)
- Elkhorn Coral (*Acropora palmata*)
- Staghorn Coral (*Acropora cervicornis*)

Additionally, on October 10, 2009, NMFS received a petition from the Center for Biological Diversity to list 83 species of coral as threatened or endangered under the ESA and to designate critical habitat for the corals listed in the petition. Initial review of the petition identified 82 of these coral species as warranting further review for a status determination. Seven of those 82 species are known to occur in waters around Isla Piñeros: *Agaricia lamarcki, Montastraea annularis, Montastraea faveolata, Montastraea franksi, Dendrogyra cylindrus, Dichocoenia stokesii,* and *Mycetophyllia ferox*. While no decision on listing these species has been made, because USN would avoid intrusive work in areas with hard or soft corals, this action would present no potential to impact the corals currently under consideration for listing under the ESA.

No underwater detonation activities are proposed. Potential impacts to the six protected marine species could result from the underwater investigation of MEC/MPPEH and transfer of MEC/MPPEH to MEC demolition and MPPEH processing areas on Isla Piñeros.

Demolition of MEC through controlled detonations on Isla Piñeros could result in impacts to protected species that occur on the island. Protected species that could occur on Isla Piñeros include:

- Hawksbill Sea Turtle
- Leatherback Sea Turtle
- Green Sea Turtle
- Piping Plover (*Charadrius melodus*)
- Roseate Tern (*Sterna dougalii*)
- Brown Pelican (*Pelecanus occidentalis occidentalis*)
- Yellow-shouldered Blackbird (*Agelaius xanthomus*)
- Puerto Rican Boa (*Epicrates inornatus*)
- Virgin Islands Tree Boa (*Epicrates monensis granti*)

The USN previously consulted with the USFWS regarding the investigation and controlled detonation of MEC/MPPEH in terrestrial areas on Isla Piñeros. Procedures developed in this previous consultation for terrestrial detonation of MEC will be used to implement onshore detonation of MEC removed from underwater locations. USN would establish a site on Isla Piñeros where MEC transferred from underwater locations would be detonated. This safe detonation site would be selected and established to minimize the potential to impact the above listed species.

Isla Piñeros is located off the coast of Puerto Rico (Figure 1). This small island was part of the former Naval Station (NAVSTA) Roosevelt Roads and was used for various military training exercises from the late 1950s until the closing of Roosevelt Roads in 2004. Naval Activity Puerto Rico (NAPR) was established to provide caretaker services for the former NAVSTA Roosevelt Roads, including Isla Piñeros, on 1 April 2004.

The Department of the Navy anticipates transferring control of Isla Piñeros to an agency of the Commonwealth of Puerto Rico. Due to the past military operations, MEC is potentially present in underwater areas around the island. To facilitate transfer of the islands and to reduce the explosive threats to the public, USN proposes to investigate the potential presence of MEC in and around suspected underwater demolition areas surrounding Isla Piñeros, and to remove for demolition and demilitarization any MEC that may be found and this is determined safe to move.

Potential impacts from demolition of MEC in terrestrial areas on Isla Piñeros have been addressed under separate ESA consultation. This BA addresses the potential impacts that may result from MEC investigation and removal in underwater areas near Isla Piñeros.

No underwater detonation is proposed as part of this action. Should any MEC be identified that cannot be transferred to a surface detonation site, USN would initiate separate consultation with USFWS and NMFS at a later date to develop appropriate mitigation measures that would allow underwater detonation in-place without impacts to protected marine species that are covered in this determination and also any other protected species that may utilize Isla Piñeros. Additionally, concurrent with consultation regarding underwater demolition and protected species, USN also would consult with NMFS regarding potential impacts to Essential Fish Habitat (EFH) if underwater detonation is determined to be necessary.

3. PROPOSED ACTION

Previous evaluation identified three historical suspected underwater demolition areas around Isla Piñeros (Figure 2). These areas are also likely sites for public boat anchorages and some of these areas are potential snorkeling or diving sites. Because of the potential for boat anchoring, snorkeling, and diving, the three suspected underwater demolition areas shown, along with the areas between the island and the suspected underwater demolition areas, will be investigated for the presence of MEC to a depth of 12 inches below the seafloor surface. MEC that is found and is determined safe to move will be transferred to a beach on Isla Piñeros for demolition. MEC that is not safe to move will be left in place and protected with sandbags; such MEC will be destroyed at a later date after further consultation with USFWS and NMFS.

3.1 Investigate Underwater MEC/MPPEH and Transfer to Surface Detonation/Processing Site

At each suspected underwater demolition area (Figure 2), a series of transects will be established extending ropes from the beach to the far side of the suspected underwater demolition area. Care will be taken to avoid damaging corals or seagrass during the placement of transect ropes. Equipment will be kept out of areas with corals or seagrass. Ropes delineating transects will not be pulled through areas with coral or seagrass. Divers will keep the rope above coral or seagrass until the transect is established, then the rope will be carefully lowered to avoid damaging the coral or seagrass. Rope removal will be accomplished in a similar manner by carefully lifting and then removing from above the coral or seagrass.

Divers will use handheld magnetometers to identify metallic anomalies, which may represent MEC or MPPEH. Anomalies will be removed from approximately ten percent of the total area of each underwater investigation area. The anomalies will be intrusively investigated by manual excavation to determine the source of each anomaly. Anomalies that are exposed or only shallowly buried will be removed by hand and transported to the beach for demolition. Anomalies that are deeply buried or that are located in areas where removal of the item could result in damage to sensitive species, such as in hard or soft coral areas, will be accurately mapped and left in place for possible later investigation. Additionally, any MEC that cannot be safely removed and transported will be covered with sandbags, mapped by GPS, and left in place for later demolition.

Some MEC/MPPEH may be removed from areas where seagrasses grow. In these areas, MEC/MPPEH that can be removed without disturbing the root system of seagrasses will be transported to the designated demolition/processing area for disposal. Additionally, exposed or shallowly buried MEC that can be removed by hand while maintaining the integrity of the root/rhizome structure of seagrasses also will be transported for demolition/processing. In these areas, intact plugs of seagrass will be removed and then replanted following removal of the MEC/MPPEH.

Exposed or shallowly buried MEC/MPPEH that can be safely moved will be transported to a designated detonation/processing site on a beach on Isla Piñeros. MEC will be demolished on Isla Piñeros by controlled detonation with the use of donor explosives. MPPEH that cannot be thoroughly inspected on all surfaces or that requires demilitarization may be subjected to controlled detonation to expose interior surfaces for inspection.

Prior to the MEC/MPPEH investigation and removal effort, a qualified biologist will verify the locations of any hard or soft coral or sea grass within the proposed MEC/MPPEH investigation and removal areas and will mark the coral locations with temporary underwater buoys or other visual devices.

A qualified biologist will train all team members on the identification of sea turtles and manatees, and on the signs of sea turtle nesting. A trained qualified observer will scan the area during all MEC/MPPEH investigation, removal, and handling activities to ensure that no turtles or manatees are within visual range of underwater operations. If the qualified observer or any other personnel observe manatees or sea turtles, all investigation, removal, and handling operations will cease until they have left the visual observation area.

The MEC/MPPEH investigation areas are adjacent to beaches. No intrusive investigation, MEC/MPPEH removal, or MEC/MPPEH handling in these three areas will be conducted during the 48-hour period following the emergence of Hawksbill hatchlings on the associated beach.

Once an anomaly is reacquired, the MEC/MPPEH investigation team will expose and recover the anomaly source using hand tools (such as spades, trowels, shovels). The MEC/MPPEH investigation team will transfer recovered MEC/MPPEH to the shore of Isla Piñeros. MEC/MPPEH will be processed at a designated location on the island. Following two independent inspections, MPPEH will be designated as Material Documented as Safe (MDAS) and transported off of Isla Piñeros for final disposal.

MEC that is not safe to move will be left in place. The MEC will be covered with sandbags and the coordinates of the item will be recorded using GPS. No underwater detonations will occur under this action. If underwater detonations are deemed necessary for the demolition of MEC, USN will initiate a separate consultation with NMFS and USFWS under the ESA. This consultation will address appropriate mitigation methods that would allow in-place detonation of MEC without adversely affecting protected marine species.

EFH will not be affected by the investigation and removal of underwater MEC/MPPEH or the subsequent terrestrial detonation and processing of recovered MEC/MPPEH. If any MEC is identified that is not safe to move, it will be left in place for later underwater detonation. USN will consult with NMFS regarding EFH if it is determined that future underwater detonation that could result in potential impacts to EFH is necessary.

3.2 Surface Detonation and Processing of Recovered MEC/MPPEH

Prior to removal of MEC/MPPEH from underwater locations, USN will establish a designated MEC/MPPEH detonation/processing site on Isla Piñeros. All recovered underwater MEC/MPPEH will be transferred to this site for demolition, processing, and inspection prior to being removed from Isla Piñeros for final disposal. The MEC/MPPEH processing site will be established on a beach to provide convenient access by MEC removal teams working in the offshore waters and to minimize disturbance of vegetation on the island.

Prior to establishing a MEC/MPPEH detonation/processing area, a qualified biologist will inspect the proposed location and the surrounding area for the presence of sea turtles, sea turtle nests, and signs of recent sea turtle activity. Daily beach surveys will be conducted by a qualified observer to determine whether sea turtles are using beaches on Isla Piñeros. If the work occurs during the sea turtle nesting season (June 1 through November 30), these daily beach surveys will begin two weeks prior to MEC/MPPEH investigation/removal. Any turtle nests located during this inspection will be clearly marked with flagging and a 100-meter protection zone will be established around the nest. The MEC/MPPEH detonation/processing site will be located more than 100 meters from nests.

Immediately prior to establishing a MEC/MPPEH detonation/processing site, a qualified biologist will inspect the proposed location and the surrounding area for the presence of nests or roosts of protected avian species. Any avian nests or roosts located during inspection would be clearly marked with flagging and a 100-meter protection zone will be established around the nest or roost. The MEC/MPPEH detonation/processing site will be located more than 100 meters from nests or roosts.

All MEC/MPPEH detonation/processing is planned during daylight hours, minimizing the possibility that hatchlings would emerge from the nests during working hours. However, work crews will examine the beach landing area for the designated MEC/MPPEH detonation/processing site upon approach and will not land any boats or disembark any workers to transfer or detonate MEC if hatchlings are observed. Detonation will be delayed until 48 hours have passed from the time of hatchling observation on the beach.

During training of qualified observers, the qualified biologist also will train personnel in identification of the protected avian species that may occur on Isla Piñeros. Prior to MEC/MPPEH detonation/processing, a qualified observer will check the beach and adjacent waters for the presence of protected bird species by scanning the area with 10 X 50 binoculars. If any protected bird species are within 200 meters of the detonation site, MEC/MPPEH detonation/processing will be delayed until after the animal(s) leave the area.

Immediately prior to detonation, a qualified observer will scan the overhead sky for the presence of any birds. If birds are in flight within 100 meters of the detonation site, the detonation will be delayed until no birds are within 100 meters of the detonation site.

4. LOCATION AND SETTING DESCRIPTION

4.1 Location

Isla Piñeros is located in the Caribbean Sea, approximately one-half mile east of the former Roosevelt Roads Naval Station on the eastern coast of Puerto Rico (Figure 1).

4.2 Setting Description

Isla Piñeros is approximately 1 mile by 0.5 mile in size with an approximate area of 310 acres. The topography of Isla Piñeros is characterized by a series of smooth, round hills and low-lying swampy areas (Figure 2). The hills range in elevation from less than 70 feet in the northwest to 250 feet above MSL in the south-central portion of the island. The most significant area of swamp is located on the southwestern portion of the island, and two others are located in the northeastern portion of the island. Isla Piñeros is surrounded by mostly narrow (less than ten-foot-wide) sandy beaches, with a few areas of steep rocky cliffs adjacent to the ocean. Coral reefs border the north and east coastlines.

The areas to be investigated in the USN proposed action are three offshore areas (Figure 2), which have been designated UW-1, UW-2, and UW-3. All three sites are near beaches.

5. SPECIES DESCRIPTIONS

5.1 Hawksbill Sea Turtle

The hawksbill is a small to medium-sized sea turtle. In the U.S. Caribbean, nesting females average 62 - 94 cm in straight carapace length. Weight is typically 43 - 75 kg. The following characteristics distinguish the hawksbill from other sea turtles: two pairs of prefrontal scales; thick, posteriorly overlapping scutes on the carapace; four pairs of coastal scutes; two claws on each flipper; and a beak-like mouth. The epidermal scutes that overlay the bones of the shell are the tortiseshell of commerce. These epidermal scutes are unusually thick, and carpacial scutes are often richly patterned with irregularly radiating streaks of brown or black on an amber background. The scutes of the plastron of Atlantic hawksbills are usually clear yellow, with little or no dark pigmentation. The soft skin on the ventral side is cream or yellow, and may be pinkish-orange in mature individuals. The scales of the head and forelimbs are dark brown or black with sharply defined yellow borders. There are typically four pairs of inframarginal scales. The head is elongate and tapers sharply to a point. The lower jaw is V-shaped.

Hawksbills utilize different habitats at different stages of their life cycle. Posthatchling hawksbills occupy the pelagic environment, taking shelter in weedlines that accumulate at convergence points. Hawksbills reenter coastal waters when they reach approximately 20-25 cm carapace length. Coral reefs are the resident foraging habitat of juveniles, subadults and adults. This habitat association results from the hawksbill's diet of sponges, which need solid substrate for attachment. The ledges and caves of reefs provide shelter for resting both during the day and night. Hawksbills are also found around rocky outcrops and high energy shoals, which are also optimum sites for sponge growth. Hawksbills may inhabit mangrove-fringed bays and estuaries, where coral reefs are absent. In Texas, juvenile hawksbills are associated with stone jetties.

Hawksbills utilize both low- and high-energy nesting beaches in tropical oceans of the world. Both insular and mainland nesting sites are known. Hawksbills will nest on small pocket beaches and, because of their small body size and great agility, can traverse fringing reefs that limit access by other species. They exhibit a wide tolerance for nesting substrate type. Nests are typically located landward of the beach in dense vegetation.

The hawksbill occurs in tropical and subtropical seas of the Atlantic, Pacific and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas); in the Greater and Lesser Antilles; and along the Central American mainland south to Brazil. Within the United States, hawksbills are most common in Puerto Rico and its associated islands, and in the U.S. Virgin Islands.

Nesting within the southeastern United States occurs principally in Puerto Rico and the U.S. Virgin Islands, the most important sites being Mona Island and Buck Island. Nesting also occurs on other beaches of St. Croix, and on Culebra Island, Isla de Vieques, mainland Puerto Rico, St. John and St. Thomas. Within the continental United States, nesting is restricted to the southeast coast of Florida and Florida Keys.

The hawksbill turtle was listed as endangered in 1970. It is a solitary nester, making population trends or estimates difficult. In 1983, the only known apparently stable populations were in Yemen, northeastern Australia, the Red Sea, and Oman. Commercial exploitation is the major cause of the continued decline of the hawksbill sea turtle. There is a continuing demand for the hawksbill's shell as well as other products including leather, oil, perfume, and cosmetics. Prior to being certified under the Pelly Amendment, Japan had been importing about 20 metric tons of hawksbill shell per year.

5.2 Leatherback Sea Turtle

The leatherback is the largest living turtle, and is so distinctive as to be placed in a separate taxonomic family, Dermochelyidae. The carapace is distinguished by a rubber-like texture, about 4 cm thick, and made primarily of tough, oil-saturated connective tissue. No sharp angle is formed between the carapace and the plastron, resulting in the animal being somewhat barrel-shaped. The average curved carapace length for adult turtles is 155 cm and weight ranges from 200-700 kg. Hatchlings are mostly black on the dorsal side; the flippers are margined in white, and rows of white scales appear as stripes along the length of the back. Hatchlings average 61.3 mm long and 45.8 g in weight. In the adult, the skin is black and scaleless. The undersurface is mottled pinkish-white and black. The front flippers are proportionally longer than in any other sea turtle, and may span 270 cm in an adult. In both adults and hatchlings, the upper jaw bears two tooth-like projections at the premaxillary-maxillary sutures. Age at sexual maturity is unknown.

The leatherback turtle's range extends from Cape Sable, Nova Scotia, south to Puerto Rico and the U.S. Virgin Islands. Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide. Nesting occurs from February - July with sites located from Georgia to the U.S. Virgin Islands. During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to the middle of Florida.

The leatherback turtle was listed as endangered throughout its range in 1970. Nesting populations of leatherback sea turtles are especially difficult to discern because the females frequently change beaches. However, current estimates are that 20,000-30,000 female leatherbacks exist worldwide. Habitat destruction, incidental catch in commercial fisheries, the harvest of eggs and flesh are the greatest threats to the survival of the leatherback.

The recovery plan for the leatherback sea turtle concludes that nesting trends in the United States appear stable. Populations have declined in Mexico, Costa Rica, Malaysia, India, Sri Lanka, Thailand, Trinidad, Tobago, and Papua New Guinea. The collapse of these nesting populations was precipitated by a tremendous overharvest of eggs, direct harvest of adults, and incidental mortality from fishing. In the Atlantic and Caribbean, the largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Nesting data for these locations have been collected since the early 1980's and indicate that the annual number of nests is likely stable; however, information regarding the status of the entire leatherback population in the Atlantic is lacking.

5.3 Green Sea Turtle

Adult green turtles may reach a size of 1 m long and 180 kg mass. The carapace is smooth and is colored gray, green, brown and black. The plastron is yellowish white. Hatchlings weigh about 25 g, and are about 50 mm long. Hatchlings are black on top and white on the bottom. Age at sexual maturity is estimated at 20-50 years.

In the southeastern United States, green turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Massachusetts. The primary nesting sites in U.S. Atlantic waters are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico.

The green sea turtle was listed as endangered/threatened in, 1978. The breeding populations off Florida and the Pacific coast of Mexico are listed as endangered while all others are threatened. Total population estimates for the green turtle are unavailable, and trends are particularly difficult to assess because of wide year-to-year fluctuations in numbers of nesting females, difficulties of conducting research on early life stages, and long generation time. The recovery team for the green turtle concluded that the species status has not improved appreciably since listing. The greatest cause of decline in green turtle populations is commercial harvest for eggs and food. Other turtle parts are used for leather and jewelry, and small turtles are sometimes stuffed for curios. Incidental catch during commercial shrimp trawling is a continuing source of mortality that adversely affects recovery.

5.4 West Indian Manatee

The West Indian Manatee is a large gray or brown aquatic mammal. Adults average about 10 feet long and weigh 1,000 pounds. They have no hindlimbs, and their forelimbs are modified as flippers. Manatee tails are flattened horizontally and rounded. Their body is covered with sparse hairs and their muzzles with stiff whiskers. Sexes are distinguished by the position of the genital openings and presence or absence of mammary glands. Manatees will consume any aquatic vegetation available to them and sometimes even shoreline vegetation. Although primarily herbivorous, they will occasionally feed on fish.

In Puerto Rico, manatees apparently occur around the southern and eastern end of the island and around nearby Isla de Vieques. Except for rare sightings, manatees seem to be absent from the Virgin Islands. There are an estimated 60 to 100 manatees in Puerto Rico. The average proportion of first-year calves in the population is 10 percent with a range of 5 to 15 percent.

The West Indian manatee was listed as endangered in 1967. Initial population decreases probably resulted from overharvesting for meat, oil, and leather. Today, hunting is prohibited and is not considered a problem, although there is an occasional incidence of poaching. Heavy mortality does occur, however, from accidental collisions with boats and barges, and from canal lock operations. Another closely related factor in the decline has been the loss of suitable habitat through incompatible coastal development, particularly destruction of seagrass beds by boating facilities. In Puerto Rico, the primary cause of manatee mortality seems to be from entanglement in gill nets. Collisions with boats and illegal killing of manatees for food may also be affecting the Puerto Rican population to some extent.

5.5 Elkhorn Coral

Elkhorn coral is a large branching coral with exceptionally thick and sturdy antler-like branches. It was formerly the dominant species in shallow water (1-5 m depth) throughout the Caribbean, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Colonies are fast growing, with branches capable of increasing in length by 5-10 cm per year. Colonies typically reach their maximum size in approximately 10-12 years.

Elkhorn coral is found on coral reefs throughout the Caribbean area. Colonies prefer exposed reef crest and fore reef environments in depths of less than 6 meters, although isolated corals may occur to 20 meters. The dominant mode of reproduction for elkhorn coral is asexual with new colonies forming when branches are broken off of a colony and reattach to suitable substrate. This life history trait allows rapid population recovery from physical disturbances, but, it makes recovery from disease or bleaching episodes (where entire colonies or even entire stands may be killed) very difficult.

Since 1980, populations have collapsed throughout the range from disease outbreaks, with losses compounded locally by hurricanes, increased predation, bleaching, and other factors. This species is particularly susceptible to damage from sedimentation. In areas where loss has been quantified, estimates are in the range of 90-95% reduction in abundance since 1980.

Elkhorn coral was listed as threatened under the Endangered Species Act (ESA) on May 9, 2006 (71 CFR 26852).

5.6 Staghorn Coral

Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over two meters in length and height. This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by 10-20 cm per year.

Staghorn coral is found throughout the Caribbean area. It occurs in back reef and fore reef environments from 0 to 30 m depth. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Fore reef zones at intermediate depths (5-25 m) were formerly dominated by extensive single species stands of staghorn coral until the mid 1980s. The dominant mode of reproduction for staghorn coral is asexual with new colonies forming when branches break off a colony and reattach to the substrate. This life history trait allows rapid population recovery from physical disturbances such as storms, but it makes recovery from disease or bleaching episodes (where entire colonies or even entire stands may be killed) very difficult.

Since 1980, populations have collapsed throughout the range from disease outbreaks, with losses compounded locally by hurricanes, increased predation, bleaching, and other factors. This species is particularly susceptible to damage from sedimentation and sensitive to temperature and salinity variation. Populations have declined by up to 98% throughout the range, and localized extirpations have occurred.

Staghorn coral was listed as threatened under the Endangered Species Act (ESA) on May 9, 2006 (71 CFR 26852).

5.7 Puerto Rican Boa

The Puerto Rican boa is the largest snake native to Puerto Rico, reaching lengths of 6 to 9 feet. The color is variable, usually ranging from tan to very dark brown (sometimes grayish), with 70-80 dorsal blotches (indistinct cross-bars) from neck to vent. The Puerto Rican boa is nocturnal and remains dormant throughout the day, retreating to caves, rocky areas along streams, or trees for concealment during the day. Adult prey items include small mammals, birds, and bats. Juveniles feed on smaller prey items including lizards and insects.

Large-scale habitat destruction and the introduction of exotic mammalian predators are considered the likely causes of population declines, although human predation to obtain their oil as a folk remedy. Introduced rats and feral cats predate upon the eggs and young.

The Puerto Rican boa is listed as Endangered. The species is known from Isla Culebra, Puerto Rico, and Isla de Vieques, but is not known from Isla Piñeros. Surveys conducted in 2006 during MEC investigations did not locate the Puerto Rican boa on the island. Isla Piñeros has a large population of exotic rats and the presence of large numbers of these pests makes it unlikely that the species would survive on the island.

5.8 Virgin Islands Tree Boa

The Virgin Islands tree boa is a blotched brown semi-arboreal snake restricted to a number of islands from Puerto Rico eastward into the British Virgin Islands. The Virgin Islands tree boa lives in subtropical dry forests where it hunts at night and captures lizards while they sleep in trees. During the day, it remains in termite nests or under rocks and debris. There are no current estimates of the number of Virgin Island boas, but they are rare and their extremely disjunct current distribution indicates past extirpation from islands and overall population decline.

Large-scale habitat destruction and the introduction of exotic mammalian predators caused severe population declines. The Indian mongoose, feral and domestic cats, and two rat species predate on eggs and young and adult boas. The small, uninhabited cays and islets where the species has become concentrated are vulnerable to inundation from oceanic storms.

The Virgin Islands tree boa was listed as Threatened in 1970. The species is known from Isla Culebra, Puerto Rico but not from Isla Piñeros. Surveys conducted in 2006 during MEC investigations did not locate the Virgin Islands boa on the island. Isla Piñeros has a large population of exotic rats and the presence of large numbers of these pests makes it unlikely that the species would survive on the island.

5.9 Piping Plover

The piping plover is a small, stocky, sandy-colored bird resembling a sandpiper. Adults have yellow-orange legs, a black band across the forehead from eye to eye, and a black ring around the base of the neck. It runs in short starts and stops and blends into the sandy habitat on outer beaches where it feeds and nests when it is stationary.

Population decline in this species resulted from multiple factors. Development has decreased coastal habitat and has resulted in increased numbers of predators such as raccoons, skunks, and foxes. Human disturbance, vehicular and on foot, disrupts nesting and can result in brood failure. Pets, especially dogs, may harass the birds during foraging and nesting and domestic and feral cats will predate on plover eggs and chicks.

The piping plover was listed under the Endangered Species Act in 1986. Subsequent recovery has more than doubled the population, but the Atlantic population remains at fewer than 2,000 pairs. The piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. These birds winter primarily on the Atlantic Coast from North Carolina to Florida, although some migrate to the Bahamas and West Indies. There are winter occurrences recorded from Puerto Rico, but the species does not nest in there.

5.10 Roseate Tern

The roseate tern is a medium-sized, colonial-nesting, marine waterbird with a worldwide distribution. It is a slender bird with a typical body length of 35 - 40 cm. It has a deeply forked tail with white streamers, 15 - 25 cm in length, and a wingspan of approximately 60 cm. Upper and lower body surfaces are paler than that of the common tern (*S. hirundo*), which is similar in appearance. Both common terns and roseate terns have a dark carpal bar over the bend of the wing in winter plumage, although it is slightly lighter in roseate terns

The North American subspecies is divided into two breeding populations, one in the northeastern United States and Nova Scotia, and the other in the southeastern United States and islands of the Caribbean Sea. Roseate terns are distributed throughout the Caribbean, with the largest populations in the Lesser Antilles. Population numbers are not known, but estimated at 3,000 to 6,000 breeding pairs for the region. There was an estimated 25 percent decline in population from 1976 to 1979.

The Caribbean breeding population of the roseate tern was listed as Threatened in 1987. Caribbean roseate terns typically select sparsely vegetated, rocky offshore islands for nesting, although they may nest on sandy beaches. Foraging typically occurs in the surf along beaches. Predation of eggs and birds, as well as poaching of eggs and adults for human consumption, is the major threats to this species. Disturbance early may cause nest abandonment or exposure of eggs to extreme temperatures. Winter habitat is concentrated along the north and northeastern coasts of South America. It is not known if the two populations of the North American subspecies winter in proximity.

5.11 Caribbean Brown Pelican

The brown pelican is a large dark gray-brown water bird with white about the head and neck. The Caribbean subspecies resembles the eastern subspecies, but the Caribbean brown pelican has a darker non-breeding plumage and darker undersurface plumage during breeding than the eastern brown pelican. The species can weigh up to 8 pounds and have a wingspan of over 7 feet.

Brown pelicans typically nest in colonies in mangrove trees, or similarly sized vegetation, on small coastal islands. Ground nesting also may occur. Tree nests are well built from sticks, reeds, straw, palmetto leaves, and grasses. Ground nests may be made of similar materials, or may be on bare ground. The Caribbean brown pelican begins nesting between May and August and nesting peaks during September through November. Normal clutch size for the brown pelican is three eggs. Males and females share in incubation and rearing duties. The Caribbean brown pelican occurs in the West Indies and other Caribbean Islands and to Guyana and Venezuela in South America.

In Puerto Rico, the brown pelican is known to breed at nine sites located at Anasco on the west coast, Montalva Bay on the southwestern coast, and at Cayo Conejo, off Isla de Vieques on the southeastern coast. Foraging is primarily in shallow estuarine waters and the species seldom ventures more than 20 miles from the coast. Sand spits and offshore sand bars are used extensively as daily loafing and nocturnal roost areas.

The brown pelican was listed as threatened in 1970. On February 20, 2008, the USFWS proposed delisting the species due to its rangewide recovery. Food appears to be the dominant factor affecting the Caribbean brown pelican populations. The timing and success of the breeding cycle is closely linked to alternating but unpredictable periods of food abundance and scarcity. Most breeding occurs in the U.S. Virgin Islands, but adult and juvenile pelicans migrate to Puerto Rico after nesting, presumably to exploit more predictable food resources in extensive estuarine and mangrove systems. Young pelicans frequently remain in Puerto Rico for 5 years before their first breeding. Adults seem to remain in Puerto Rico until they meet pre-breeding nutritional requirements and return to breeding colonies. The most serious man-induced threats to the Caribbean brown pelican are poaching of eggs, young, and adults; human disturbance; entanglement in fishing gear; and loss or degradation of mangrove forests.

5.12 Yellow-Shouldered Blackbird

There are two subspecies, *Agelaius xanthomus xanthomus*, known only from Puerto Rico and formerly from Isla de Vieques, and *Agelaius xanthomus monensis*, which occurs only on Mona and Monito Islands. The yellow-shouldered blackbird is a medium-sized (20 to 23 centimeters) glossy black bird with yellow epaulets. male and female plumage is similar. Immature birds are a duller than adults and have a brown abdomen. The yellow epaulets are usually edged with a narrow white margin.

The breeding season extends from April through August and appears to coincide with onset of spring rains. The yellow-shouldered blackbird is monogamous, with pairing beginning 6 to 10 weeks prior to breeding. Pairs display site fidelity and re-establish nests in areas used in previous years. Yellow-shouldered blackbirds nest in scattered mangroves and in cavities in dead trees and stumps.

The yellow-shouldered blackbird was listed as endangered in 1976 and critical habitat was designated for the species. Isla Piñeros is not within or near any of the designated critical habitat in Puerto Rico. The yellow-shouldered blackbird was widespread and abundant in Puerto Rico and Mona Island until the 1940s. Loss of habitat, predation by exotic mammals (cats and rats), and brood parasitism by the shiny cowbird have since contributed to its drastic decline in numbers, estimated at more than 80 percent reduction in population size.

5.13 Seven Species of Coral Proposed for Listing Under the ESA

On October 10, 2009, NMFS received a petition from the Center for Biological Diversity to list 83 species of coral as threatened or endangered under the ESA and to designate critical habitat for the corals listed in the petition. Initial review of the petition identified 82 of these coral species as warranting further review for a status determination. Seven of those 82 species are known to occur in waters around Isla Piñeros: *Agaricia lamarcki, Montastraea annularis, Montastraea faveolata, Montastraea franksi, Dendrogyra cylindrus, Dichocoenia stokesii, Mycetophyllia ferox*. These species are briefly described below based on information (Center for Biological Diversity, 2009). Threats to these species include pollution, climate change, and loss of habitat.

Agaricia lamarcki forms colonies that typically are flat and composed of explanate or encrusting plates arranged in whorls. The corallites form in concentric valleys with widely spaced centers. *Agaricia lamarcki* is rust brown in color, with pale margins and white, star-shaped mouths. The species is common in intermediate to deep water (15 to 25 meters) and in highly turbid shallower water (10 to 15 meters). *Agaricia lamarcki* can be found throughout the Caribbean, the Gulf of Mexico, Florida, and the Bahamas.

Montastraea annularis forms large, branching, colonies of long, thick, disjunct and irregular columns up to 2 meters in length. Living tissue is generally restricted to the tops of columns and comprises closely packed and uniformly distributed corallites that form a smooth surface. Column sides nearest the live tissue margin have few small polyps that are typically do not actively grow while column sides farther from the live tissue tend to be fouled and eroded. *Montastraea annularis* can be found throughout the Caribbean, the Gulf of Mexico, Florida, and the Bahamas.

Montastraea faveolata has been referred to as the dominant reef-building coral of the Atlantic Ocean. *Montastraea faveolata* buds to form head or sheet colonies with uniformly distributed corallites that are closely packed, but sometimes unevenly exserted Septocostae are arranged in a conspicuous fan system and the skeleton is generally much less dense than other *Montastraea* species. Active growth typically occurs at the edges of colonies, forming a smooth outline with many small polyps. *Montastraea faveolata* occurs at depths similar to but broader than *Montastraea annularis*, with significant overlap. *Montastraea faveolata* can be found throughout the Caribbean, the Gulf of Mexico, Florida, and the Bahamas.

Montastraea franksi builds massive, encrusting plate or subcolumnar colonies via budding. The characteristically bumpy appearance of this species results from relatively large, unevenly exserted, and irregularly distributed corallites. *Montastraea franksi* is distinguished from other *Montastraea* species by its irregular or bumpy appearance and its relatively dense, heavy, and hard skeleton. *Montastraea franksi* thicker septocostae that possess a conspicuous septocostal midline row of lacerate teeth compared to other *Montastraea* species. *Montastraea franksi* can be found throughout the Caribbean, the Gulf of Mexico, Florida, and the Bahamas.

The genus Dendrogyra is monospecific, with *Dendrogyra cylindrus* the only species. *Dendrogyra cylindrus* propagates by fragmentation and thrives in shallow, well-circulated areas. *Dendrogyra cylindrus* colonies typically occur on flat or gently sloping back reef and fore reef environments in depths of 1 to 25 meters. The species does not occur in extremely exposed locations. Colonies comprise cylindrical columns up to 2 meters high on top of encrusting bases. Valleys meander with two thick, alternating orders of septocostae. Because the septocostae do not join at the tops of valleys, there is a neat groove along the tops of the walls. During the day, tentacles typically remain extended, giving *Dendrogyra cylindrus* a furry and conspicuous appearance. The species is resistant to heavy wave surge but occasionally topples when the base of the colony bioerodes. Typically, if this happens, the upper portions of the colonies survive and new pillars are produced that continue to grow upward. *Dendrogyra cylindrus* can be found throughout the Caribbean, the Gulf of Mexico, Florida, and the Bahamas.

Dichocoenia stokesii colonies tend to be either massive and spherical or form thick plates with evenly spaced corallites. The septocostae usually occur in two neatly alternating orders. Though sometimes green, *Dichocoenia stokesii is* usually orange-brown with white septocostae. *Dichocoenia stokesii* is uncommon but occurs in most reef environments within its range, including back and fore reef environments, rocky reefs, lagoons, spur and groove formations, channels, and occasionally at the base of reefs. *Dichocoenia stokesii* occurs in depths ranging from 2 to 72 meters. When found in exposed reefs at depths less than 20 meters, its heads are more abundant than in other environments. *Dichocoenia stokesii* can be found throughout the Caribbean, the Gulf of Mexico, Florida, and the Bahamas.

Mycetophyllia ferox colonies consist of flat plates with radiating valleys. Colonies consist of thin, weakly attached plates with interconnecting, slightly sinuous, narrow valleys. Tentacles are generally absent and corallite centers tend to form single rows. Valleys and walls are contrasting shades of grays and browns. While *Mycetophyllia ferox* is most abundant in fore reef environments at depths of 10 to 20 meters, but also occurs in a broader range of habitats including deeper back reefs and lagoons. *Mycetophyllia ferox* can be found throughout the Caribbean, the Gulf of Mexico, Florida, and the Bahamas.

At this time, no decision on whether to list these species has been made by NMFS.

6. EFFECTS OF PROPOSED ACTION IMPLEMENTATION

The MEC acquisition and transfer described under the Proposed Action have the potential to affect the hawksbill sea turtle, leatherback sea turtle, green sea turtle, West Indian manatee, elkhorn coral, and staghorn coral. These federally listed species may occur in the waters near Isla Piñeros. There also could be potential to affect seven species of coral currently proposed for listing under the ESA which may occur in waters around Isla Piñeros. In addition, MEC/MPPEH demolition/processing at detonation sites on Isla Piñeros has the potential to affect the hawksbill sea turtle, leatherback sea turtle, green sea turtle, piping plover, roseate tern, brown pelican, yellow-shouldered blackbird, Puerto Rican boa, and the Virgin Islands tree boa. These species may occur on Isla Piñeros. Effects analysis in this document focuses on the elements associated with each activity and their potential impacts to protected species. The following discussion of potential impacts is divided by location (offshore or onshore).

6.1 Reacquire underwater MEC and transfer to surface detonation site

Investigation and removal of MEC/MPPEH will be conducted over approximately ten percent of each underwater investigation area. The three underwater MEC investigation areas (UW-1, UW-2, and UW-3) are near beaches (Figure 2) and have the potential for sea turtle activity. Typically this activity would be transient swimming and the sea turtles would be expected to avoid the area where active MEC/MPPEH removal was underway. Area UW-2 is adjacent to a coral reef (Figure 2) and it is possible that MEC/MPPEH investigation/removal activity would temporarily displace hawksbill sea turtles from potential foraging areas. The MEC/MPPEH investigation/removal would not result in physical intrusion into the coral reef.

All MEC/MPPEH investigation/removal would be conducted during daylight, so nocturnal sea turtle nesting activities would not be affected. MEC/MPPEH investigation/removal crews will be trained in sea turtle and West Indian manatee identification. Where sea turtles or manatees are sighted underwater, the MEC/MPPEH investigation/removal crew will cease work and vacate the area until the animals have moved on. A qualified observer will assist the survey crew by patrolling the surrounding area for sea turtles and manatees while the MEC removal team is at work.

Underwater MEC/MPPEH investigation/removal and subsequent transfer of MEC/MPPEH to demolition/processing sites on Isla Piñeros will require a visual survey of underwater areas and adjacent coral reefs to determine if Hawksbill sea turtles are foraging. If Hawksbill sea turtles are foraging on the reef, MEC investigations must be delayed until sea turtles have left the area.

Underwater MEC/MPPEH investigation/removal and subsequent transfer of MEC/MPPEH to demolition/processing sites on Isla Piñeros may disrupt the return of sea turtles to a nesting beach and it is possible that the disturbance could be sufficient to make a turtle abandon a beach. A qualified observer will investigate each underwater MEC/MPPEH investigation/ removal area and the surrounding underwater area for sea turtles prior to and during MEC/MPPEH investigation/removal activities. If turtles are active in the investigation area or the immediately surrounding ocean, the MEC/MPPEH investigation/removal must be delayed until this activity had passed.

No MEC/MPPEH investigation/removal in UW-1, UW-2, or UW-3 will be conducted during the 48-hour period following the emergence of Hawksbill hatchlings on the associated beach.

Underwater MEC removal and transfer will be implemented with the conditions specified above. The proposed activities are not likely to affect the three sea turtle species or the West Indian manatee.

Coral reefs around Isla Piñeros and locations of elkhorn and staghorn corals were identified and mapped on July 19, 2006. Site investigations determined that UW-1, UW-2, and UW-3 included or were in proximity to coral reefs containing elkhorn and staghorn corals. A qualified biologist will verify the distribution of corals prior to the start of MEC/MPPEH removal. No MEC/MPPEH investigation/removal in coral areas will be conducted unless the MEC/MPPEH is lying on the surface of the substrate and can be removed entirely by hand. No corals, including elkhorn, staghorn, and hard corals, will be dislodged or broken by this work. The proposed activities are not likely to affect the two coral species.

While no decision has been made by NMFS on whether to list the seven species under consideration, there would be no potential to impact any corals from this action with implementation of the protective measures described above. The USN would avoid intrusive work in areas with hard or soft corals.

USN anticipates that all underwater MEC/MPPEH can be transferred to a terrestrial MEC/MPPEH investigation/processing site and disposed of without underwater blasting. Should MEC be found that cannot be transferred to an upland demolition site, it would be necessary to detonate that MEC in-place, but that would not be done under the proposed USN action. USN would initiate separate consultation with USFWS and NMFS and would develop appropriate mitigation measures to prevent underwater blasts from adversely affecting protected marine species, including corals, that may occur in the waters around Isla Piñeros. The separate consultation would address the marine species that are covered in this determination and also any additional protected species that may utilize Isla Piñeros.

6.2 Surface detonation of reacquired underwater MEC

Prior to removal of MEC/MPPEH from underwater locations, USN will establish a designated MEC/MPPEH investigation/processing site on Isla Piñeros. All removed underwater MEC/MPPEH will be collected at this site for demolition and demilitarization, as needed, and processing for final disposal off of Isla Piñeros. The MEC/MPPEH investigation/processing site will be established on a beach to provide convenient access by MEC removal teams working in the offshore waters and to minimize the potential to disturb vegetation on the island.

Because the MEC/MPPEH investigation/processing site would be established on a beach, it would be away from any habitats that might be used by the Puerto Rican boa or the Virgin Islands tree boa. There would be no potential for the surface detonation of reacquired underwater MEC to impact these species.

Prior to establishing the MEC detonation site, a qualified biologist will inspect the proposed detonation site and the surrounding area for the presence of sea turtles, sea turtle nests, and signs of recent sea turtle activity. Daily beach surveys will be conducted by a qualified observer to determine whether sea turtles are using beaches on Isla Piñeros. If the work occurs during the sea turtle nesting season (June 1 through November 30), these daily beach surveys will begin two weeks prior to MEC/MPPEH investigation/removal. Any turtle nests located during this inspection will be clearly marked with flagging and a 100-meter protection zone will be established around the nest. The MEC/MPPEH investigation/processing site will be located more than 100 meters from nests. The proposed activity is unlikely to affect nesting activities of the hawksbill sea turtle, leatherback sea turtle, and green sea turtle.

Immediately prior to establishing a MEC/MPPEH investigation/processing site, a qualified biologist or observer will inspect the proposed detonation site and the surrounding area for the presence of nests or roosts of protected avian species. Any avian nests or roosts located during inspection would be clearly marked with flagging and a 100-meter protection zone will be established around the nest or roost. The MEC/MPPEH investigation/processing site will be located more than 100 meters from nests or roosts. The proposed activity is unlikely to affect nesting or roosting activities of the piping plover, roseate tern, brown pelican, and yellow-shouldered blackbird.

All detonation is planned during daylight hours, minimizing the possibility that hatchlings would emerge from the nests during working hours. However, work crews and qualified observers will examine the beach landing area for the designated MEC detonation site upon approach and will not land any boats or disembark any workers to transferor detonate MEC if hatchlings are observed. Detonation will be delayed until 48 hours have passed from the time of hatchling observation on the beach.

Prior to ordnance detonation at the MEC/MPPEH investigation/processing site, a qualified observer will check the beach and adjacent waters for the presence of sea turtles. If any sea turtles are onshore and are within 200 meters of the detonation site, MEC detonation will be delayed until after the animal(s) leave the area. The proposed activity is unlikely to affect nesting activities of the hawksbill sea turtle, leatherback sea turtle, and green sea turtle.

Prior to ordnance detonation at the MEC/MPPEH investigation/processing site, a qualified observer will check the beach and adjacent waters for the presence of protected bird species by scanning the area with 10 X 50 binoculars. If any protected bird species are within 200 meters of the detonation site, MEC detonation will be delayed until after the animal(s) leave the area. The proposed activity is unlikely to affect nesting activities of the piping plover, roseate tern, brown pelican, and yellow-shouldered blackbird.

Immediately prior to detonation, a qualified observer will scan the overhead sky for the presence of any birds. If birds are in flight within 100 meters of the detonation site, the detonation will be delayed until no birds are within 100 meters of the detonation site. The proposed activity is unlikely to affect nesting activities of the piping plover, roseate tern, brown pelican, and yellow-shouldered blackbird.

7. CONCLUSION

The USN proposes to investigate and remove MEC/MPPEH from the waters around Isla Piñeros in three areas that have been designated as UW-1, UW-2, and UW-3. These areas have been identified as potential offshore anchorage locations, as well as potential snorkeling and scuba diving locations, for persons visiting Isla Piñeros. The proposed work would entail establishing transects from the beach through areas identified as suspected historical underwater demolition areas, investigation of metallic anomalies along the transects, transfer of recovered MEC/MPPEH to terrestrial MEC/MPPEH investigation/processing sites on Isla Piñeros, demolition and demilitarization of MEC/MPPEH by controlled detonation at the terrestrial MEC/MPPEH investigation/processing sites, and processing of this material for final disposal at an approved off-site disposal facility.

The hawksbill sea turtle may nest on Isla Piñeros during the period June 1 through November 30. During the nesting period, sea turtles may be found landward within 50 meters of the high tide line on beaches. Hawksbill sea turtles also may be present in the waters around Isla Piñeros at other times of the year. Procedures that would be implemented during MEC/MPPEH investigation/removal would prevent adverse impacts to this species. The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, are **not likely to affect** hawksbill sea turtle and would not threaten the continued existence of the species.

Leatherback and green sea turtles may nest on the beaches of Isla Piñeros and also may forage in areas surrounding the island. Procedures that would be implemented during MEC removal operations would prevent adverse impacts to these species. The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, are **not likely to affect** leatherback and green sea turtles and would not threaten the continued existence of these species.

The West Indian manatee is an occasional visitor to the waters off Isla Piñeros and also may forage in these waters. Procedures that would be implemented during MEC removal operations would prevent adverse impacts to this species. The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, are **not likely to affect** the West Indian manatee and would not threaten the continued existence of this species.

The elkhorn and staghorn corals occur in reefs adjacent to Isla Piñeros. Suitable reef habitat for these species occurs in proximity to Isla Piñeros. Procedures that would be implemented during MEC removal operations would prevent adverse impacts to these species. The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, are **not likely to affect** elkhorn and staghorn corals and would not threaten the continued existence of these species.

On October 10, 2009, NMFS received a petition from the Center for Biological Diversity to list 83 species of coral as threatened or endangered under the ESA and to designate critical habitat for the corals listed in the petition. Initial review of the petition identified 82 of these coral species as warranting further review for a status determination. Seven of those 82 species are known to occur in waters around Isla Piñeros: *Agaricia lamarcki, Montastraea annularis, Montastraea faveolata, Montastraea franksi, Dendrogyra cylindrus, Dichocoenia stokesii, Mycetophyllia ferox*. While no decision on whether to list these species has been made, there would be **no potential to impact** the corals currently under consideration for listing under the ESA from this action because USN would avoid intrusive work in areas with hard or soft corals.

The Puerto Rican boa and the Virgin Islands tree boa would not occur on Isla Piñeros. The surface detonation of transferred underwater MEC would be done on a beach in habitat these species would not use. Therefore, surface detonation of transferred underwater MEC would not affect the Puerto Rican boa and the Virgin Islands tree boa. The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, are **not likely to affect** the Puerto Rican boa and the Virgin Islands tree boa and would not threaten the continued existence of these species.

The piping plover may occur on Isla Piñeros as a winter resident or transient. Underwater MEC transfer and surface detonation may result in temporary displacement of animals, but would not adversely affect this species. Procedures that would be implemented during MEC removal operations would prevent adverse impacts to this species. The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, are **not likely to affect** piping plover and would not threaten the continued existence of this species.

The roseate tern, the Caribbean brown pelican, and the yellow-shouldered blackbird may occur on Isla Piñeros during the period when Underwater MEC transfer and surface detonation is proposed. Underwater MEC transfer and surface detonation may result in temporary disturbance to and relocation of animals foraging near the MEC removal and disposal sites. Procedures that would be implemented during MEC removal operations would prevent adverse impacts to these species. The USN requests NMFS and USFWS concurrence with the determination of findings of this analysis that the investigation, removal, and transfer of MEC/MPPEH from the above-identified areas on Isla Piñeros, followed by the terrestrial demolition, demilitarization, and processing of MEC/MPPEH, are **not likely to affect** the roseate tern, Caribbean brown pelican, or yellow-shouldered blackbird and would not threaten the continued existence of these species.

USN anticipates that all underwater MEC/MPPEH can be transferred to a terrestrial MEC/MPPEH demolition/processing site and disposed of without underwater blasting. Should MEC be found that cannot be transferred to a terrestrial MEC/MPPEH demolition/processing site, it would be necessary to detonate that MEC in-place. USN would initiate separate consultation with USFWS and NMFS and would develop appropriate mitigation measures that would be implemented to prevent the underwater blast from adversely affecting protected marine species that may occur in the waters around Isla Piñeros. The separate consultation would address the marine species that are covered in this determination and also any additional protected species that may utilize Isla Piñeros.

8. REVIEW OF LITERATURE AND OTHER INFORMATION

All pertinent literature was reviewed. The following summary indicates the primary references utilized during preparation of this biological assessment.

Center for Biological Diversity. 2009. Petition To List 83 Coral Species Under The Endangered Species Act. October 20, 2009.

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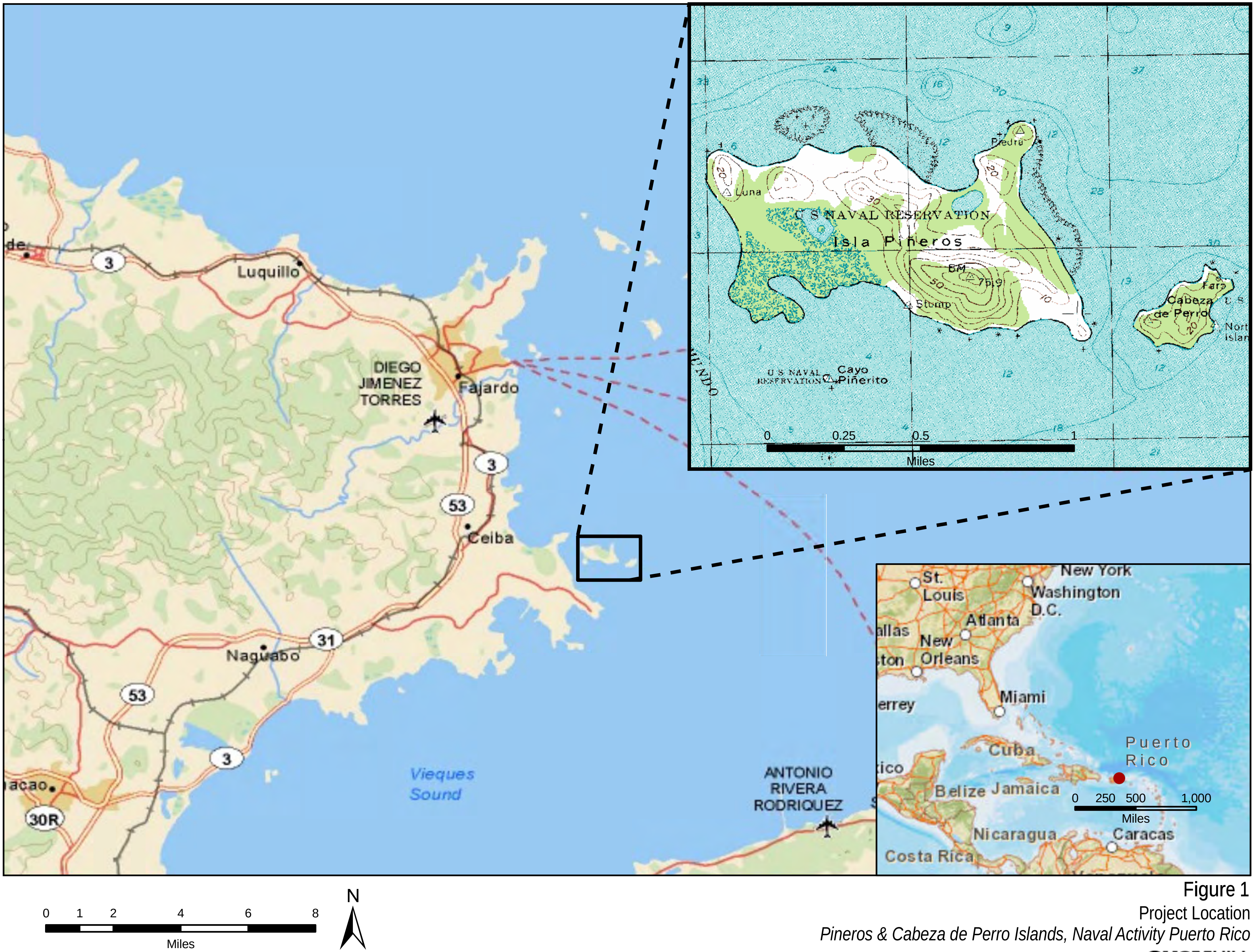

Figure 1
Project Location
Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico
CH2MHILL

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VICINITY MAP

LEGEND
Planned Underwater Investigation Area
Historic Underwater Investigation Area

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FIGURE 2
Planned Underwater Investigation Areas
Pineros Island
Puerto Rico

Figure 3
Beach at Underwater Investigation Area UW-2
Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Figure 4
Beach at Underwater Investigation Area UW-3
Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

United States Department of the Interior

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Boqueron, PR 00622
DEC 3 0 2010

Mr. Mark Davidson
BRAC PMO SE
4130 Faber Place Dr.
Suite 202
N. Charleston, SC 29405

Re: Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern at Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico

Dear Mr. Walker:

Thank you for you letter dated November 30, 2010, received in our office on December 2, 2010, requesting comments on the proposed project. As per your request, our comments constitute technical assistance and are provided under the Endangered Species Act (Act) (87 Stat. 884, as amended; 16 United States Code 1531 et seq.), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The United State Navy (USN) is proposing to conduct investigations on the water of Isla Piñeros. The investigation will be to find and remove munitions and explosives of concerns (MEC) and material potentially presenting an explosive hazard (MPPEH).

We concur with the determinations that this action is not likely to adversely affect the fish and wildlife resources under our jurisdiction.

However, in order to minimize possible adverse effects we believe that conservation measures outlined in the BA must be follow in addition with the next comments and recommendations:

1. Surface detonation site should be located on the rocky side of the beach. The sand beaches associated with each UW site are pocket beaches that usually end in beach rock on either side of the sandy area. If at all possible beach rock substrate should be used. In Addition precaution to avoid fires shall be taken during all detonations.

2. Sea grass rhizome mat could be cut with a blade and peeled back to help expose any MPPH or MEC. This method allows for immediate replacement of the sea grass with minimal disturbance. It may be necessary to fasten the mat to the bottom with short pieces of "U" shaped rebar.

It is our mission to work with others, to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of our people. If you have any additional question regarding this issue, please do not hesitate to contact Rafael González at 787-851-7297 extension 214. You may also visit our website http://www.fws.gov/caribbean for additional information on threatened and endangered species under jurisdiction and the programs to conserve them.

Sincerely yours,

Edwin Muñiz

Edwin E. Muñiz
Field Supervisor
Caribbean Field Office

rg / fhl

cc:

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

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April 22, 2011 F/SER4:JR/pw

(Sent via Electronic Mail)

Dr. Richard Reaves
CH2M HILL, Northpark 400
1000 Abernathy Road, Suite 1600
Atlanta, GA 30328

Dear Dr Reaves:

NOAA's National Marine Fisheries Service (NMFS) reviewed *EFH* [essential fish habitat] *Determination for the Investigation of Underwater Munitions and Explosives of Concern, Isla Piñeros, Puerto Rico* (EFH Assessment) dated February 2011 and prepared by CH2MHILL under contract task order JM03, NAVFAC CLEAN 1000 Program, Contract N62470-08-D-100. The EFH Assessment was provided to NMFS on February 14, 2011, via email from CH2MHILL and describes the potential impacts from removal of munitions and explosives of concern (MEC) at three sites around Isla Piñeros, Puerto Rico. As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the following comments and recommendations are provided pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

The mandatory contents of EFH assessments are described 50 CFR 600.920(e)(3). A key element is the federal agency's conclusions regarding the effects of the action on EFH. Under 50 CFR 600.920(c) a federal agency may delegate a non-federal representative to conduct an EFH consultation by giving written notice of such delegate to NMFS (although the federal action agency remains ultimately responsible for compliance with sections 305(b)(2) and 305(b)(4)(B) of the Magnuson-Stevens Act). While we have not had any communication from the Navy indicating that CH2MHILL is authorized to conduct the EFH consultation with us on the Navy's behalf, we reviewed EFH Assessment and request the Navy advise NMFS by letter, email, or phone on future projects when a non-federal representative will be conducting an EFH consultation for the Navy.

Project Description
Three areas in the waters off of Isla Piñeros are identified as suspected as historical underwater demolition areas (each area is approximately 3.7 acres). These areas are also likely sites for public boat anchorages and some would be potential snorkeling or diving sites. Because of the potential for unauthorized recreational activities within the three suspected underwater demolition areas, these areas and the areas between the island and the suspected underwater demolition areas would be investigated for the presence of MEC and material potentially presenting an explosive hazard (MPPEH) to a depth of 12 inches below the seafloor surface. Handheld magnetometers would be used to identify potential MEC or MPPEH. Small shovels or trawls would used to investigate the magnetic anomalies disturbing the sediment as little as possible; about 2 square feet per investigation. MEC that is found and is determined safe to remove would be transferred to upland beach on Isla Piñeros for demolition; no underwater

demolition is proposed. MPPEH at depths greater than 12 inches and MEC that is not safe to move would be left in place. Sediments would then be carefully placed back into the hole and any seagrass removed would be replanted as plugs; alternatives such as "pealing" seagrass mats were determined to likely be too damaging to rhizome mats. Preliminary examinations show about 185 magnetic anomalies are expected to be identified for recovery.

MEC that is not safe to move would be destroyed at a later date under a separate action after further consultation with the US Fish and Wildlife Service and NMFS. No MEC recovery is proposed in mangrove areas. Onshore demolition would not occur in mangrove areas. Best management practices are described in the EFH Assessment to reduce the likelihood of boats and investigators inadvertently damaging seagrass, coral, or soft coral while performing investigations and removals.

Conclusion
The site of the proposed project includes seagrass, hard and soft corals, sandy bottom, and algal communities. The Caribbean Fishery Management Council indentifies these habitats as EFH for several species, including juvenile and adult gray snapper (*Lutjanus griseus*); and juvenile mutton snapper (*Lutjanus analis*); juvenile nassau (*Epinephelus striatus*) and goliath grouper (*Epinephelus itajara*); and juvenile spiny lobster (*Panulirus argus*) and queen conch (*Strombus gigas*). Based on the information provided, NMFS finds the project would have some minimal impacts on EFH, primarily seagrass and agrees with CH2MHILL that seagrass would likely recover from the impacts through natural processes. The removal of MEC found buried 12 inches under seagrass needs to happen in order to help clear the area for civilian use. No EFH conservation recommendations are provided.

Thank you for the opportunity to provide these comments. Related questions or comments should be directed to the attention of Mr. José A. Rivera at NOAA HCD, c/o US Army Corps of Engineers, 400 Fernandez Juncos Avenue, San Juan, Puerto Rico, 00901-3299. He may be reached by telephone at 787-501-7639 or by e-mail at Jose.A.Rivera@noaa.gov.

Sincerely,

Pace Willer

/ for

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc:

CH2MHILL, Richard.Reaves@CH2M.com
U.S. Navy, Stacin.Martin@navy.mil
F/SER3, Lisamarie.Carrubba@noaa.gov
F/SER4, David.Dale@noaa.gov
F/SER47, Jose.A.Rivera@noaa.gov, Jocelyn.Karazsia@noaa.gov

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APR 08 2011 F/SER31:LC

Mr. Mark Davidson
BRAC PMO SE
4130 Faber Place Drive
Suite 202
Charleston, SC 29405

Re: Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern at Isla Piñeros, Naval Activity Puerto Rico

Dear Mr. Davidson:

This responds to the November 30, 2010, letter from Mr. Thomas Roth of CH2MHill, submitted on behalf of Naval Facilities Engineering Command (Navy), and a Biological Assessment (BA) for the investigation of underwater munitions and explosives of concern at Piñeros Island, Puerto Rico, dated November 2010. NMFS participated in a conference call on September 29, 2010, with CH2MHill and the Navy. We discussed the underwater investigation and techniques to be employed by the Navy to avoid and minimize potential impacts to listed species. These include hawksbill and green sea turtles (known to frequent waters around Piñeros Island), leatherback sea turtles that may be present around Piñeros Island if work occurs during nesting season, and elkhorn and staghorn corals and their designated critical habitat. The proposed investigation of underwater munitions and explosives of concern (MEC) will occur at three sites around Piñeros Island. Information contained in the BA, and additional information provided via e-mail in January 2011, included measures related to vessel operation to avoid and minimize potential impacts on listed sea turtles and corals and their habitat. Information was also provided on methods to be employed to ensure the MEC investigation results in minimal disturbance to the marine bottom in seagrass areas and no bottom disturbance in coral areas. Based on these measures, the Navy has determined that the proposed MEC investigation may affect, but is not likely to adversely affect, listed species under NMFS' jurisdiction. You are reminded that any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS.

The project is located at Piñeros Island, part of the former Roosevelt Roads Naval Station, Ceiba, Puerto Rico (approximate position 18.24734°N, 65.58393°W). The Navy proposes the investigation of underwater MEC based on the results of a geophysical investigation conducted in 2006. MEC investigation will take place in three areas around the island (UW-1, UW-2, UW-3 on the enclosed figure) that were identified as areas where underwater training activities took place, and where geophysical anomalies were detected during a sonar survey in 2006. Note that the underwater demolition area (UW-4) off Cabeza de Perra Island will not be studied and the Navy proposed no further underwater investigation of this site. According to the information included in the BA and the supplemental information received via e-mail, the Navy has included measures to address NMFS' concerns related to potential adverse effects to listed species and their habitat due to the proposed underwater investigation of MEC off Piñeros Island. The underwater investigation will be performed using hand-held magnetometers along a transect that will be laid out from the shoreline seaward to the boundary of the underwater demolition area at the start of underwater operations. The transects will allow approximately ten percent of each underwater demolitions area to be investigated. Suspected MEC on the surface along the transect will be collected, if personnel determine that the items are safe to move, and transported to Piñeros Island for demolition or stockpiled on the island for transport and disposal. If the metal detector operated by the diver along a transect detects an anomaly, the diver will hand dig to a depth of one foot. If the item is deeper, then the diver will mark the point with GPS and refill the hole. If the item is within one foot and can be removed, then the diver will remove the item and transport it to Piñeros Island. If the item is within one foot and the diver does not believe it is safe to move, then the diver will mark the GPS location. In sand bottom areas, items that are determined to be unsafe to move will have sandbags placed on top of them. No hand excavation will take place in coral or hardbottom areas. Divers will mark the location of anomalies using GPS as they swim along transects. In seagrass areas, the seagrass will be cut in a way that keeps the root system intact, placed back over the hole after the hole has been filled with sand if necessary, and staked with biodegradable stakes to enable the grass to reestablish quickly. The Navy has determined that if suspected MEC is identified during the underwater investigation that cannot be removed without blow-in-place, or that suspected MEC buried deeper than one foot cannot be investigated without mechanical excavation, then these removal actions will be considered under a separate BA and a separate Section 7 consultation will be required for those actions.

Listed species under the purview of NMFS that occur in the area include hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), and green sea turtles (*Chelonia mydas*). Benthic surveys conducted by the Navy around Piñeros Island, as well as a site inspection of UW-2 and UW-3 in which a NMFS' biologist participated on February 12, 2008, did not reveal the presence of any live listed coral colonies. Designated critical habitat for listed corals, including dead elkhorn coral skeletons, was mapped in UW-2 and is likely present in UW-1, but sea conditions did not allow a visual in-water inspection during the site visit. The physical feature of critical habitat that is essential to the conservation of listed corals is substrate of suitable quality and availability, in water depths from the mean high water line to 30 m, to support successful larval settlement, recruitment, and reattachment of fragments. Substrate of suitable quality and availability means consolidated hardbottom or dead coral skeletons free from fleshy macroalgae and sediment cover.

NMFS has analyzed the routes of potential effects to listed sea turtles and designated coral critical habitat from the proposed action and determined that these potential effects include the following: impacts to listed sea turtles due to collisions with vessels or interference with their normal behavior due to diving operations; impacts to sea turtle refuge and foraging habitat from vessel anchoring and accidental groundings, and the excavation of suspected MEC from areas containing seagrass beds; and impacts to designated coral critical habitat from vessel anchoring and accidental groundings.

NMFS believes that the proposed action may affect but is not likely to adversely affect leatherback, hawksbill, and green sea turtles. Leatherback, hawksbill, and green sea turtles in the water could be affected by vessel transit to Piñeros Island. However, the Navy will implement measures that were previously developed in coordination with NMFS for previous consultations (see NMFS' letter dated April 21, 2010, enclosed) to avoid and minimize the potential for collisions with sea turtles. These measures include limiting the number of vessels to two dive boats and restricting their size to under 40 feet in length, as well as using a shallow-draft dinghy to transport equipment and personnel to the shoreline. In addition, an observer will be on each vessel and will scan the water for the presence of listed sea turtles. If sea turtles are observed, boats will not come within 500 feet of the animals and will allow the animals to move out of the boat's path before continuing. Prior to the commencement of dive operations, observers will assess whether sea turtles are present. If sea turtles are observed, then no operations will commence until the turtles have moved out of the area. Further, the Navy will not conduct any underwater work within 48 hours of the nest emergence of sea turtle hatchlings to ensure that hatchlings are not affected by the underwater investigation activities. The presence of hatchlings will be known because a sea turtle observer will conduct beach monitoring as required by the U.S. Fish and Wildlife Service (USFWS). The Navy has conducted a separate Section 7 consultation with USFWS and has developed measures, in coordination with USFWS, to avoid impacts to sea turtle nests related to the demolition of suspected MEC that can be transported from the underwater investigation sites to land. Therefore, NMFS believes that impacts to listed sea turtles due to collisions with vessels transiting to Piñeros Island will be discountable. NMFS also believes that impacts to listed sea turtles due to diving operations will be discountable.

Hawksbill and green sea turtles could be affected by loss of refuge and foraging habitat as a result of anchor damage and accidental groundings. Green sea turtle foraging habitat could be affected by the excavation of suspected MEC. Designated coral critical habitat could be impacted due to anchor damage and accidental groundings. However, the Navy will ensure that boats anchor in unvegetated sandy areas and will avoid anchoring in areas containing seagrass and corals. During the underwater investigations, green sea turtle foraging habitat could be impacted because divers will hand dig to a depth of one foot in areas where metal detectors indicate there is an anomaly. In seagrass areas, the seagrass will be cut in a way that keeps the root system intact, placed back over the hole after the hole has been filled with sand if necessary, and staked with biodegradable stakes to enable the grass to reestablish quickly. In terms of designated coral critical habitat, based on benthic surveys and a site inspection, UW-3 is dominated by seagrass beds and UW-2 contains large areas of unvegetated sand bottom where boats can anchor without damage to seagrass or coral habitat. Further, based on benthic surveys and a site inspection, the areas containing the essential feature of coral critical habitat are located around points around Piñeros Island outside the area where vessels will transit. During the underwater investigation, divers will only remove surface anomalies from coral areas and no intrusive investigation will be conducted. Therefore, NMFS believes that the impacts to refuge and foraging habitat for listed sea turtles and designated coral critical habitat related to vessel traffic and the underwater investigation, are discountable.

This concludes the Navy's consultation responsibilities under Section 7 of the ESA for the proposed action. Be advised that a new consultation must be initiated if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action.

Thank you for your efforts to ensure the conservation of protected species and their habitat. If you have any questions regarding our position on the proposed project or the Section 7 consultation process, please contact Dr. Lisamarie Carrubba at (787) 851-3700, or by e-mail at lisamarie.carrubba@noaa.gov. We have enclosed additional information on NMFS' Public Consultation Tracking System to allow you to track the status of future ESA consultations.

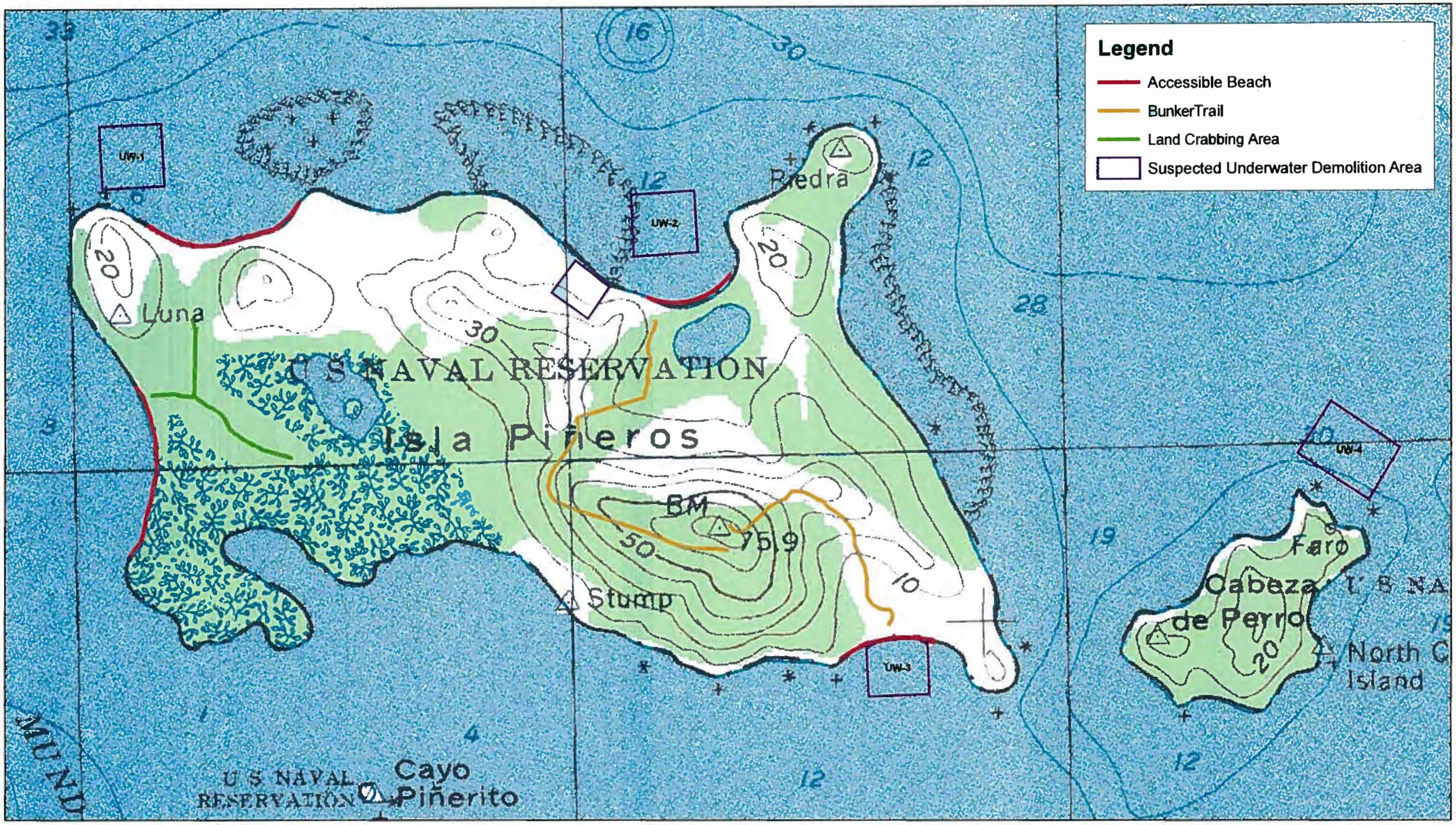
Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosures

cc: Roth – CH2MHill

File: 1514-22.G
Ref: I/SER/2010/05794



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1 inch equals 600 feet

Figure 1-5
Proposed Investigation Areas
Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico

CH2MHILL

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APR 21 2010

F/SER31:LC

Mr. Mark Davidson
BRAC PMO SE
4130 Faber Place Drive
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Charleston, SC 29405

Re: Biological Assessment for Removal of Munitions and Explosives of Concern, Isla Piñeros, Naval Activity, Puerto Rico

Dear Mr. Davidson:

This responds to your January 6, 2010, letter from Mr. Thomas Roth of CH2MHill, submitted on behalf of Naval Facilities Engineering Command (Navy), and a Biological Assessment (BA) for removal of munitions and explosives of concern (MEC) dated December 2009. The National Marine Fisheries Service (NMFS) received a version of the BA dated May 2008. NMFS recommended that the BA be amended to include information regarding the potential impacts to listed hawksbill and green sea turtles that are known to frequent waters around Piñeros Island, as well as listed elkhorn and staghorn corals and their designated critical habitat, associated with the mobilization of resources to Piñeros Island in order to perform the MEC investigation specifically, the transport of personnel and equipment in vessels. Based on the inclusion of measures related to vessel operation to avoid and minimize potential impacts on listed sea turtles and their habitat, the Navy has determined that the proposed MEC investigation may affect, but is not likely to adversely affect, listed species under NMFS' jurisdiction. You are reminded that any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS.

The project is located at Piñeros Island, part of the former Roosevelt Roads Naval Station, Ceiba, Puerto Rico (approximate position 18.24734°N, 65.58393°W). The Navy proposes the investigation and removal of subsurface MEC based on a survey of geophysical anomalies in 2006. MEC investigation and removal will take place in certain beach areas, a bunker trail, and on-land crabbing areas (i.e., areas where humans hunt land crabs for consumption) where geophysical anomalies were detected. According to the information included in your letter and the BA, the Navy has included measures to address NMFS' concerns related to potential adverse effects to listed species (detailed below) due to vessel traffic to Piñeros Island.

Listed species under the purview of NMFS that occur in the area include hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), and green sea turtles (*Chelonia mydas*). Benthic surveys conducted by the Navy around Piñeros and Cabeza de Perro Islands, as well as a site inspection in which a NMFS' biologist participated on February 12, 2008, did not reveal the presence of any live listed coral colonies around Piñeros Island. Designated critical habitat for listed corals is present in the project area, including dead elkhorn coral skeletons. The physical feature of critical habitat that is essential to the conservation of listed corals is substrate of suitable quality and availability, in water depths from the mean high water line to 30 m, to support successful larval settlement, recruitment, and reattachment of fragments. Substrate of suitable quality and availability means consolidated hardbottom or dead coral skeletons free from fleshy macroalgae and sediment cover.

NMFS has analyzed the routes of potential effects to listed sea turtles and designated coral critical habitat from the proposed action and determined that these potential effects include the following: impacts to listed sea turtles due to collisions with vessels; impacts to sea turtle refuge and foraging habitat from vessel anchoring and accidental groundings; and impacts to designated coral critical habitat from vessel anchoring and accidental groundings.

NMFS believes that the proposed action may affect but is not likely to adversely affect leatherback, hawksbill, and green sea turtles. Leatherback, hawksbill, and green sea turtles in the water could be affected by vessel transit to Piñeros Island. However, the Navy will implement measures to avoid and minimize the potential for collisions with sea turtles, including limiting the number of vessels to two and restricting their size to under 40 feet in length, as well as using a dinghy to transport equipment to the shoreline due to its shallow draft. In addition, an observer will be on each vessel and will scan the water for the presence of listed sea turtles. If sea turtles are observed, boats will not come within 500 feet of the animals and will allow the animals to move out of the boat's path before continuing. Therefore, NMFS believes that impacts to listed sea turtles due to collisions with vessels transiting to Piñeros Island will be discountable. Hawksbill and green sea turtles could be affected by loss of refuge and foraging habitat as a result of anchor damage and accidental groundings. Designated coral critical habitat could also be impacted due to anchor damage and accidental groundings. However, the Navy will ensure that boats anchor in unvegetated sandy areas and will avoid anchoring in areas containing seagrass and corals. In terms of designated coral critical habitat, based on benthic surveys and a site inspection, the bays where the vessels will access the island are dominated by seagrass beds. In addition, as noted previously, the Navy will ensure that boats anchor in unvegetated sandy bottom. Further, based on benthic surveys and a site inspection, the areas containing the PCE of coral critical habitat are located around points around Piñeros Island outside the area where vessels will transit. Therefore, NMFS believes that the impacts to refuge and foraging habitat for listed sea turtles and designated coral critical habitat related to vessel traffic to Piñeros Island during the MEC investigation are discountable.

This concludes the Navy's consultation responsibilities under section 7 of the ESA for the proposed action. Be advised that a new consultation must be initiated if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action. In addition, because the Navy has determined that underwater MEC investigation and possible removal actions will be considered under a separate BA, a separate section 7 consultation will be required for this action. We have enclosed additional information on NMFS' Public Consultation Tracking System to allow you to track the status of future ESA consultations.

Thank you for your efforts to ensure the conservation of protected species and their habitat. If you have any questions regarding our position on the proposed project or the Section 7 consultation process, please contact Dr. Lisamarie Carrubba at (787) 851-3700, or by e-mail at lisamarie.carrubba@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

cc: Roth – CH2MHill

File: 1514-22.G
Ref: I/SER/2010/00067

PCTS Access and Additional Considerations for ESA Section 7 Consultations (Revised 7-15-2009)

Public Consultation Tracking System (PCTS) Guidance: PCTS is an online query system at **https://pcts.nmfs.noaa.gov/** that allows federal agencies and U.S. Army Corps of Engineers' (COE) permit applicants and their consultants to ascertain the status of NMFS' Endangered Species Act (ESA) and Essential Fish Habitat (EFH) consultations, conducted pursuant to ESA section 7, and Magnuson-Stevens Fishery Conservation and Management Act's (MSA) sections 305(b)2 and 305(b)(4), respectively. Federal agencies are required to enter an agency-specific username and password to query the Federal Agency Site. The COE "Permit Site" (no password needed) allows COE permit applicants and consultants to check on the current status of Clean Water Act section 404 permit actions for which NMFS has conducted, or is in the process of conducting, an ESA or EFH consultation with the COE.

For COE-permitted projects, click on "Enter Corps Permit Site." From the "Choose Agency Subdivision (Required)" list, pick the appropriate COE district. At "Enter Agency Permit Number" type in the COE district identifier, hyphen, year, hyphen, number. The COE is in the processing of converting its permit application database to PCTS-compatible "ORM." An example permit number is: SAJ-2005-000001234-IPS-1. For the Jacksonville District, which has already converted to ORM, permit application numbers should be entered as SAJ (hyphen), followed by 4-digit year (hyphen), followed by permit application numeric identifier with no preceding zeros. For example: SAJ-2005-123; SAJ-2005-1234; SAJ-2005-12345.

For inquiries regarding applications processed by COE districts that have not yet made the conversion to ORM (e.g., Mobile District), enter the 9-digit numeric identifier, or convert the existing COE-assigned application number to 9 numeric digits by deleting all letters, hyphens, and commas; converting the year to 4-digit format (e.g., -04 to 2004); and adding additional zeros in front of the numeric identifier to make a total of 9 numeric digits. For example: AL05-982-F converts to 200500982; MS05-04401-A converts to 200504401. PCTS questions should be directed to Eric Hawk at Eric.Hawk@noaa.gov. Requests for username and password should be directed to PCTS.Usersupport@noaa.gov.

EFH Recommendations: In addition to its protected species/critical habitat consultation requirements with NMFS' Protected Resources Division pursuant to section 7 of the ESA, prior to proceeding with the proposed action the action agency must also consult with NMFS' Habitat Conservation Division (HCD) pursuant to the MSA requirements for EFH consultation (16 U.S.C. 1855 (b)(2) and 50 CFR 600.905-.930, subpart K). The action agency should also ensure that the applicant understands the ESA and EFH processes; that ESA and EFH consultations are separate, distinct, and guided by different statutes, goals, and time lines for responding to the action agency; and that the action agency will (and the applicant may) receive separate consultation correspondence on NMFS letterhead from HCD regarding their concerns and/or finalizing EFH consultation.

Marine Mammal Protection Act (MMPA) Recommendations: The ESA section 7 process does not authorize incidental takes of listed or non-listed marine mammals. If such takes may occur an incidental take authorization under MMPA section 101 (a)(5) is necessary. Please contact NMFS' Permits, Conservation, and Education Division at (301) 713-2322 for more information regarding MMPA permitting procedures.

CH2M HILL
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1000 Abernathy Road
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Atlanta, GA 30328
Tel 770.604.9095
Fax 770.604.9183

May 31, 2011

U.S. Fish & Wildlife Service
ATTN: Edwin E. Muniz, Field Supervisor
Road 301, Km 5.1
Sector Corozo
Boquerón, PR 00622

Subject: Supplemental Biological Assessment: Destruction of Underwater Munitions and Explosives of Concern on Isla Piñeros, Naval Activity Puerto Rico

Dear Mr. Muniz:

The enclosed Supplemental Biological Assessment is being submitted on behalf of our client, Naval Facilities Engineering Command and BRAC PMO Southeast.

The U.S. Navy seeks USFWS concurrence with the Supplemental Biological Assessment for proposed RFI activities. The proposed activities are not expected to adversely impact any listed threatened or endangered species. We anticipate starting work in mid-July, 2011.

The U.S. Navy POC for this project is Mr. Mark Davidson (843-743-2124; mark.e.davidson@navy.mil). Mr. Davidson's mailing address is: BRAC PMO SE, Attn: Mark Davidson, 4130 Faber Place Dr., Suite 202, N. Charleston, SC 29405.

Sincerely,

CH2M HILL

Thomas M. Roth
Principal Project Manager

cc (w/enclosure): Mr. Mark Davidson, BRAC PMO SE
Mr. Pedro Ruiz, Naval Activity Puerto Rico
Mr. Stacin Martin, NAVFAC

Supplemental Biological Assessment: Destruction of Underwater Munitions and Explosives of Concern on Isla Piñeros, Naval Activity Puerto Rico

The United States Navy (USN) has previously completed biological assessments (BAs) to assess the potential impacts of and appropriate mitigation measures from the investigation and removal of munitions and explosives of concern (MEC) and material potentially presenting an explosive hazard (MPPEH) from the waters around Isla Piñeros and from the following areas on Isla Piñeros:

- Beach Areas
- Bunker Trail
- Land Crabbing Areas

The original intent was to complete this work outside the nesting season for sea turtles so that there would be no potential to disturb nesting. This was accomplished for the three identified areas on Isla Piñeros, but it now appears that the underwater work may not be completed prior to the onset of sea turtle nesting. Because underwater MEC and MPPEH would be transferred onto Isla Piñeros for destruction, the U.S. Navy has developed a contingency plan to allow work to proceed during the sea turtle nesting period and has prepared this supplemental BA to address potential impacts to protected species on Isla Piñeros.

The two previous BAs (*Biological Assessment for Removal of Munitions and Explosives of Concern, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* [December 2009] and *Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern, Piñeros Island, Naval Activity Puerto Rico* [November 2010]) are incorporated into this supplemental BA by reference. The species of interest for this BA are hawksbill sea turtle, leatherback sea turtle, green sea turtle, Virgin Islands tree boa, Puerto Rican boa, piping plover, roseate tern, brown pelican, and yellow-shouldered blackbird Species descriptions are provided in the appendices and are not repeated in this supplemental BA.

The U.S. Navy would establish a MPPEH storage area and a separate demolition area at least 150 meters from the landward edge of the southern beach on Isla Piñeros. The detonation area would be located landward of the storage area. These areas would be established along the previously investigated and cleared bunker trail leading from the beach. Each area would be cleared of vegetation, up to a 15 foot by 15 foot square, to allow operations to proceed. No storage of MPPEH or detonation would occur on the beach.

The U.S. Navy has identified a possible route across the southern beach on Isla Piñeros that would be used to access storage and disposal areas that would be located inland from the beach. Should underwater MEC and MPPEH removal extend into the sea turtle nesting period, the U.S. Navy would have qualified biologists survey the proposed access trail to determine whether sea turtle nests occur along the trail or within 100 meters of the trail. If the trail is determined to have no nests, it would be used and no further investigation of trails would occur. If a sea turtle nest is located along the proposed route, the qualified biologist would continue to investigate the beach to determine an access route that would not cross a sea turtle nest. This investigation would extend into the fringing vegetation to make sure no leatherback nests in the fringing vegetation would be crossed by or adjacent to the access route.

Once the route is determined, the U.S. Navy would establish a temporary boardwalk across the beach to the bunker trail. All travel across the beach would be along the established boardwalk. The beach would be inspected prior to use of the boardwalk to assure no sea turtles were on the beach at the time of use. As established in the *Biological Assessment for Removal of Munitions and Explosives of Concern, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico*, no work will be conducted until the beach is clear of turtles.

Prior to clearing the proposed storage area and the proposed demolition area, these locations would be investigated by a qualified biologist to determine whether any protected or migratory avian species were nesting within the proposed area or within 100 meters of the proposed area. The locations selected would not be near any nesting birds.

All applicable mitigation measures specified in the *Biological Assessment for Removal of Munitions and Explosives of Concern, Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico* for work on Isla Piñeros would be implemented.

Operation of boats and all underwater work would not change from that described in *Biological Assessment for Investigation of Underwater Munitions and Explosives of Concern, Piñeros Island, Naval Activity Puerto Rico*.

The USN requests United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) concurrence with the determination of findings of this analysis that the demolition of MEC and MPPEH on Isla Piñeros during the sea turtle nesting period is **not likely to affect** hawksbill sea turtle, leatherback sea turtle, green sea turtle, Virgin Islands tree boa, Puerto Rican boa, piping plover, roseate tern, brown pelican, and yellow-shouldered blackbird. Additionally, the proposed actions would not threaten the continued existence of these species.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Boqueron Field Office
Carr. 301, KM 5.1, Bo. Corozo
P.O. Box 491
Boqueron, PR 00622
JUN 23 2011

Mr. Mark Davidson
BRAC PMO SE
4130 Faber Place Dr, Suite 202
N. Charleston, SC 29405

Re: Supplemental BA, Isla Piñeros, Naval Activity, Puerto Rico, FWS 72037-039

Dear Mr. Roth:

This is in reply to the May 31, 2011 letter requesting our concurrence with the Supplemental Biological Assessment for the destruction of underwater munitions and explosives of concern on Isla Piñeros, Puerto Rico. Our comments are issued in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.) and the Endangered Species Act (16 U.S.C. 1531 et. seq. as amended). We have assigned project number FWS 72037-039 to this action, please refer to it in future correspondence.

As part of the ongoing investigation of munitions and explosives of concern (MEC) the waters around Isla Piñeros were surveyed for MEC. The Navy hopes that all work would be concluded prior to the peak of turtle nesting on the island, but because any items found underwater would be transferred onto the island, a contingency plan has been developed to allow work to proceed. The Navy is proposing a single point of access across the beach via a constructed boardwalk, to access the demolition area some 150 meters from the beach. The area would be established along the existing bunker trail on the southern shore of the island. Based on the information provided we have the following comments and recommendations:

1) The sea turtle species of most concern is the hawksbill sea turtle (*Eretmochelys imbricata*) not the leatherback sea turtle as mentioned in your Supplemental BA. This species nests year-round with a peak in Aug-September. Hawksbill sea turtles are known to nest under beach vegetation and can nest as much as 50 meters inland depending on the beach area.

2) At least 60 days prior to any activity, the beach should be surveyed daily by a qualified biologist for any sea turtle nesting activity. The access route should be the shortest possible across the beach from the water's edge into the vegetation.

3) The boardwalk should be removed once all work is finished.

4) Prior and during clearing of vegetation for the proposed storage and demolition area a qualified biologist will survey the area for any federal listed or state protected species or nesting migratory birds.

Based on the above comments and recommendations, we concur with your determination that the proposed action is not likely to adversely effect nesting sea turtles, or any of the other listed species previously mentioned in the BA. Nevertheless, if the project is modified or if new information on impacts to listed species becomes available this office should be contacted concerning the need for the initiation of consultation under section 7 of the Act.

Thank you for the opportunity to comment on this project, if you have any questions please contact Felix Lopez of my staff at 787 851 7297 x210.

Sincerely,

Marelisa Ri
for Edwin Muñiz
Field Supervisor

fhl
cc:
DNER, Vicente Quevedo, San Juan
EPA, San Juan
EQB, Wilmarie Rivera, San Juan
Timothy Gordon, Remedial Project Manager, EPA, New York
Tomas Roth, CH2MHILL, Georgia